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Lectures on Fire Insurance

Seasons of 1914 1915 1916

by

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LECTURES ON FIRE INSURANCE

SEASONS OF 1914--1915--1916

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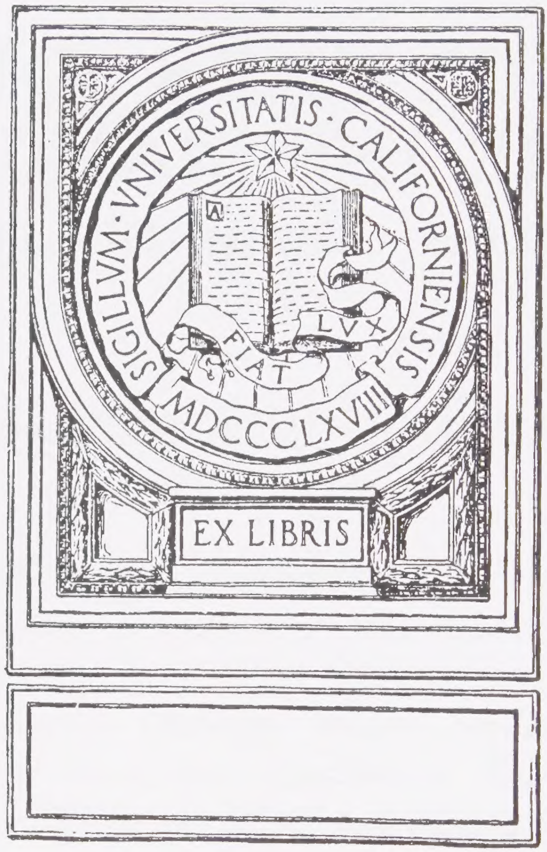
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HARTFORD, CONNECTICUT
The Insurance Institute of Hartford
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1917

THE INSURANCE INSTITUTE OF HARTFORD, INC.

1914-15-1916

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Public Water Works

BY

GEO. W. BOOTH

December 11, 1914

This subject is, as you all realize, a broad and technical one. I shall attempt, in the short time available, to discuss briefly only those features which have a more or less direct bearing on fire protection.

Preliminary to a consideration of the water works proper, it is usual to make some investigation of the organization and maintenance of the works. A great majority of the water supply systems are owned by the municipality, and the general tendency is towards an increase of municipal ownership. As a general proposition, better fire protection is likely to be furnished by municipal owned works than by privately owned, although we have examples of private ownership rendering service comparing very favorably with the best municipally owned works. Many of these plants are operated with a high degree of efficiency and with the idea that the best way to forestall municipal ownership is to render reliable and efficient service.

The best municipally owned plants are found to be under the control of trained executives and with employees appointed under properly administered civil service rules and secure tenure of office. An indication of good management is found in proper records and plans of physical structures and the operation of the system, since only by the keeping of such records and a study of them from year to year, and by comparison with similar works in other cities, are the best results to be obtained.

Most modern water works have one or more emergency crews, provided with emergency wagons loaded with the tools necessary for prompt action in case of a break in the mains or other accident. At the quarters where this crew is stationed it is usual to make provision for receiving alarms of fire; similar provisions should be made at the supply works and are especially necessary where supply is by direct pumping and pressures are increased on receipt of fire alarms. It is more or less common practice for at least one responsible employee to respond to alarms in the more important districts to coöperate with the fire department in increasing or conserving the water supply.

Water supplies may be considered under two general subdivisions, Supply Works and Distribution System; both of these must be viewed from the standpoints of adequacy and reliability.

It seems best to classify systems as Gravity, Combined and Direct Pressure, with the following definitions:

A Gravity System is one in which supply is delivered direct to the city from the source of supply without the use of pumps.

A Combined System is: (1) Where supply is pumped from the source to a distributing reservoir, and thence flows by gravity to the system; (2) Where supply is pumped to the city direct with a reservoir as an equalizer.

A Direct Pressure System is considered as one delivering by pumping direct to the distribution system, with less than one-half average day's storage in standpipe or small reservoir.

A Gravity System has usually a less number of elements likely to affect reliability, and is therefore to be preferred; it is possible, however, for the other classes of systems, properly designed and safeguarded, to reach a high degree or reliability.

One of the main points to be considered in any system is adequacy of supply, especially during such a series of dry years as most sections of the country have experienced recently. It is comparatively easy, with the experience obtained during this and other dry periods to predict the yield from any watershed in the Eastern or the Northern United States; but it is a much more difficult problem, in the Southwest for instance, where rainfall is very irregular and the run-off from any given area of watershed much more uncertain. It is usually considered that in this section of the country the watershed may be economically developed by the construction of storage reservoirs to yield from 800,000 to 1,000,000 gallons per day per square mile, requiring reservoir storage of 250,000,000 gallons per square mile of watershed or more. Where the supply is from wells, it is usual to construct storage reservoirs, either underground near the pumping station, or, if possible, at an elevation; if no such storage is provided, the minimum rate of flow must be equal to maximum domestic consumption and fire demands.

Still other sources of supply are unfailing lakes or streams, in which case the main feature to be considered is the danger of interruption on account of ice formations, floods or silting or shifting channels, etc.

Gravity systems may have supply lines or conduits leading directly from the storage reservoirs to the distribution system; they are more often provided with distributing reservoirs as near the city as possible. With such a distributing reservoir of adequate size, it is safe to rely upon a single supply line from the source, and this supply line need be only large enough to furnish maximum daily draft, since the reservoir will take

care of the difference in demand between day and night, and also of sudden large drafts for fires or other emergencies.

For proper reliability, provided there is only a single supply main from the storage reservoirs, it is considered that the distributing reservoir should have a capacity equal to five days' domestic consumption plus ten hours' fire flow. Many of the larger cities have constructed reservoirs holding even a greater supply. New York City is constructing, in connection with its new Catskill supply, a reservoir about 15 miles north of the city line and near the lower end of the aqueduct, which will hold about forty billion gallons, or the equivalent of eighty times the daily capacity of the aqueduct; there is another reservoir just north of the city line, which will hold the equivalent of about two days' supply and will equalize the daily and hourly variations of demand. Of the many breaks in large mains which are on record, there are a number where repairs have required 2 to 5 days, and it seems fair to assume a reservoir storage of 5 days as sufficient to provide for restoration of service.

There has been much discussion as to the relative merits of the different materials used in constructing force and supply mains. Cast iron is the material most commonly used in the East and Middle West, but steel and wood-stave pipe have certain advantages under conditions adapted to their use, and have given excellent service in a number of instances.

Steel pipe has been used quite extensively for supply conduits in the new Catskill works for New York, as well as in the Massachusetts Metropolitan Works, and a large number of other cities. It has the advantage of not being liable to sudden and complete rupture in case of settlement, and may have a long life if used where it is not liable to corrosion from electrolysis or adverse soil conditions; its life depends to a very large degree on securing a metal free from impurities, and on the excellence of the preservative coating.

Wood-stave pipe has been used mainly in the Northwest. Its advantages are lightness and low cost, and the ease of making repairs. The staves should be of such thickness and the pipe should be so covered with earth that the wood will be kept constantly moist and will consequently not quickly decay; if not properly constructed and laid, its life is short.

Masonry conduits were used by the Greeks and Romans before the Christian era, and where topographical conditions permit they are often the most economical type of construction for carrying large quantities of water.

For the majority of systems, it is necessary to pump the water, either to reservoirs or directly to the distribution system, and there is a great variety of conditions governing the number and size of pumps, their type and method of driving. Various methods of determining pumping capacity necessary for safe reserve have been proposed; that which has commended itself

to the engineers of the National Board as the most reasonable requires that pumping capacity, with any two pumps out of service, must, together with reservoir storage, be such as to maintain full maximum consumption for 5 days and fire flow for 10 hours. In cities of 25,000 population or less, there is less probability of fires occurring while pumps are out of commission, values are less and the conflagration hazard not so high, and the above requirement is especially severe, and it is usual to consider only one pump out of service. In the very largest cities, it may be necessary to assume more than two pumps out of service simultaneously; the general rule that one-fourth of the total number of pumps should be considered as reserve units is perhaps a reasonable one. We have records of a number of cases of two pumps out of service at once, usually while one of them was dismantled for repairs or overhauling; there are doubtless a great many other cases of which there is no record. Of course, the likelihood of this occurring during a serious fire is not great, although it has happened; and a shortage of water, occasioned either by insufficient pumping capacity or otherwise, is quite likely to be one of the reasons for the development of a serious fire. If elevated reservoir storage is provided, less pumping capacity is necessary; experience indicates that a 5-day period is sufficient to restore to service at least one of the pumps which is considered as being out of commission.

Steam-driven reciprocating pumps comprise the great majority in water works service; in recent years, however, centrifugal pumps for both low-lift and high pressure work have made great advances, being driven usually either by steam turbines or by electric motors with power in most cases from a separate generating plant. Most types of internal combustion engines are not considered to have been developed to the point where they possess the same degree of reliability as steam engines; one disadvantage has arisen from the difficulty of securing properly trained men to operate them. However, a number of installations, both in industrial and in water works plants, have been in successful operation for a number of years, and the various features which are found to be unreliable and unnecessarily complicated will doubtless be corrected as the manufacturers discover the necessity for so doing.

The self contained plant possesses a less number of elements of unreliability, although it is possible to so safeguard the various hazards in any plant as to secure entirely satisfactory service; for instance, the separate fire main systems in New York and Brooklyn, and that proposed for Boston, have electrically operated pumps with power from two or more outside sources, with underground electrical feeders in duplicate. The San Francisco separate fire main system has two self contained pumping stations, with steam-turbine driven centrifugal pumps, the Baltimore system one station with steam-engine driven

reciprocating pumps, and the Philadelphia system two stations with gas engine driven reciprocating pumps. Electrical feeders from outside sources should be in duplicate and by separate routes, and if overhead this requirement is more vital than if underground.

Other features of the supply works which it is necessary to consider include construction and hazards of pumping stations, filter plants, boilers, steam piping, and suction and discharge piping.

The most desirable type of construction for a pumping station is of course the one containing no combustible material; a few such have been constructed. The ordinary station, with no unnecessary woodwork and no concealed spaces, can be rendered reasonably safe by the installation of an automatic sprinkler system, and it is rather surprising that no more of them have been so equipped. There are probably a dozen instances during the past 6 or 8 years of the destruction by fire of pumping stations of more or less importance; some of these fires were from exposures and the others from internal hazards.

Filters are of two kinds, slow sand and rapid sand or mechanical filters, the difference being that the latter has arrangements for raking or agitating the sand during cleaning, and use a coagulant to aid in filtration. Slow sand filters are usually designed to operate normally at a rate of 3 to 6 million gallons per day per acre, depending largely upon the character of the water to be filtered; they may be forced to about double the normal rate in emergency. Rapid sand filters are usually operated at a rate of 100 to 125 million gallons per day per acre. The use of rapid sand filters has much increased in the past few years, as better methods of operating them have been devised. In some cases, the water is of sufficiently good quality to warrant by-passing filters in emergency; if not, filter capacity should be such, with one bed out of service for cleaning, to provide, together with clear water storage either at the station or in elevated reservoirs, for maximum domestic demands and 10 hours' fire flow.

It is rather difficult to specify exactly the boiler capacity necessary for proper reliability; boilers should be of such size and number as secure flexibility of operation, and at least the equivalent of the largest one should be in reserve with the required pumping capacity in operation. The best arrangement of steam piping is the loop system, so arranged and gated that a failure of the pipe will not put more than one pump or boiler out of service, and the renewal or repair of a valve not more than two units.

The suction and discharge piping about the plant is arranged to the best advantage when the same results are obtained as noted above under steam piping; of course, if adequate elevated reservoir storage is provided, it is not necessary to go to the

same extremes in guarding against interruptions of the operations of the pumps.

We have already discussed the question of adequacy and reliability of supply mains or conduits from storage reservoirs to distributing reservoirs. Force or supply mains from distributing reservoirs or pumping stations to the distribution system cannot be considered adequate unless able to deliver without too great friction loss the total quantities required for maximum domestic consumption and fire flow; for proper reliability there should be two or more of these mains, of such size that with any one out of service the others will take care of maximum demands. Good design calls for mains to be laid far enough apart so that a failure of one is not likely to affect the others, and for special precautions against failure at stream or railroad crossings or other points where breaks are most likely to occur. Parallel mains should be cross-connected and adequately gated at intervals of not more than one mile, and should have air-valves at high points and blow-offs at low points. The importance of proper design and location of these latter is sometimes underestimated; in case it becomes necessary to drain the water from a main in order to make repairs, the time consumed in draining it is often of material consequence.

We have now brought the water to the distribution system, the function of which is to furnish supply to the various parts of the city, and for the various purposes for which it is needed. These purposes naturally divide themselves into two general classes: First, ordinary uses, including domestic, commercial and public; second, fire extinguishment. The relative demands on the system as a whole vary with the size of the city and the rate of ordinary consumption, and the relative demands of the different sections of the city likewise vary with the character of occupancy.

The consumption of water for other than fire extinguishment will naturally vary greatly with the character of the city and the methods adopted to prevent waste and leakage; an accurate determination of the actual total consumption is often lacking, especially in gravity systems, on account of the absence of measuring devices on supply mains. The average per capita rate is probably about 100 to 120 gallons per day, with individual cases ranging from 30 to 350 gallons; a reasonable average for fairly well metered systems is 75 gallons, with a range from 30 to 100 gallons. The lowest figure given above represents consumption in a city with comparatively limited opportunities for using water and with practically all services metered; the highest figure is for a city where water is cheaply supplied and almost no effort is made to prevent waste and leakage.

A high rate of consumption naturally results in a lower available margin for fire protection, and the relations of maximum to average rate is also important, since provision must

be made for at least the maximum day rate. A system having a large percentage of metered services will show a low or moderate average rate, and usually a reasonable low maximum. The maximum rate occurs either in very cold weather, due to allowing fixtures to run in order to prevent freezing, or in hot, dry weather for lawn sprinkling. Average figures for a large number of cities reported on by the National Board show the daily average for the maximum month to be 27 per cent. in excess of the average for the year, the maximum day 50 per cent. in excess of the average for the year, and the maximum hourly rate about 100 per cent. in excess of the daily average for the year; in some cities, these percentages are much higher than the figures quoted.

One of the first points to be considered in the design of a system is the pressure which may be made available in the distribution system; this has a strong influence on the character of the fire protection furnished, both as respects ability to furnish hose streams directly from hydrants as against the necessity of using fire engines, and as repects ability to furnish direct supply to automatic sprinkler equipments. The earlier systems in this country were mostly low pressure, i. e., less than 40 pounds. In a number of these cases, pressures have been materially increased, usually at a time when a new supply works was being put in service; the increase in pressure is justified partly because of the necessity for better domestic service to the higher buildings now being erected, and partly by the better fire protection furnished. The tendency to follow precedent is apparently as strong in water works design as in most other fields, as illustrated by the similarity between the systems of various groups of municipalities in different parts of the country, with respect to pressures as well as other features of design.

Practically all the works now being constructed or rebuilt are designed to carry a pressure of 70 pounds or higher. This pressure, if well maintained, will provide for automatic sprinkler supply in buildings, up to about eight stories in height, but is hardly enough for direct hydrant streams, except in residential districts and in the mercantile districts of the smaller cities where practically all the buildings are less than four stories high. As noted elsewhere, hydrant distribution has much to do with the quality of the fire protection furnished; close hydrant spacing enables the use of short lines of hose and results in greater effective pressure at the nozzle.

In National Board reports, a hydrant pressure of 60 pounds in residential districts and 75 pounds in most mercantile and manufacturing districts, maintained during fire draft, have been considered the minimum for effective direct hydrant streams; and with these pressures, most of the hose lines must be of only moderate length and some fire engines should be provided for use with the longer hose lines or the powerful streams from

large nozzles and on higher buildings. A pressure of 60 pounds at the hydrant will furnish fairly effective streams for buildings not more than four stories high, through 300-foot lines of 2½-inch hose and 1⅛-inch nozzles, or through 400-foot lines of hose and 1-inch nozzles; 75 pounds will enable hose lines 100 or 150 feet longer than those above named to be used. Three-inch hose will more than double the effective radius of action of a hydrant, and should certainly be used for heavy streams.

The total amount of water used for fire extinguishment is very small, reliable estimates in a number of cities averaging about 0.1 gallon per day, or less than 40 gallons per capita per year. However, the rate at which this is likely to be required adds, in most cases, very largely to the necessary capacity of the system. In a paper presented to the American Water Works Association in 1911, it is estimated that that portion of the total cost of water works necessitated by fire protection requirements would vary from 60 per cent. in a community of 10,000 population to 15 per cent. in one of 200,000; the corresponding percentages as relates to cost of distribution system alone are estimated at 56 and 10, respectively. Public fire hydrant service is usually paid for upon the basis of an annual rental for each hydrant, and the revenue from this source seldom bears any relation to the cost or the value of the service rendered. The average hydrant rental is probably in the neighborhood of $40 per year, with a range of $5 to $100. The cost of fire hydrant service, based upon general present practice as to number of hydrants installed, is estimated in the paper above referred to at about $55. Any method of payment involving a charge per hydrant is undesirable, as tending to limit the number of hydrants below that necessary for good fire protection.

The distribution system may be considered as made up, in addition to the street mains, of valves, fire hydrants, service connections and fixtures, including those which furnish supply to sprinkler equipments and standpipes.

In designing a new system, it is necessary to decide upon the use of one of the many formulas which have been devised to determine the probable carrying capacity of different sized mains. It has been our experience that the Williams & Hazen formula, used either in connection with the book of tables or the slide rule, is the most generally convenient. The values of "C" in this formula, as given in the tables, apply very well to pipe carrying impounded surface water, such as is generally in use in this section of the country; these values show a decrease in carrying capacity of cast-iron pipe of 25 to 30 per cent. in 20 years, and of 38 to 45 per cent. in 40 years. The smaller sizes naturally show the greatest decrease. For most well waters and the harder waters found in the Great Lakes, the rate of deterioration is somewhat less, and a higher value of "C" must be used for pipe of a given age.

No pipe as small as 4-inch should be laid to supply hydrants; roughly, one 6-inch will carry the same quantity of water as three 4-inch, and one 8-inch the same quantity as six 4-inch. The recommendations as to sizes of minor distributors incorporated in most of the reports of the Committee on Fire Prevention of the National Board read as follows:

"That the following be adopted as the standard minimum size of mains used for hydrant supply for all future construction:

a. In residential districts, 8-inch; 6-inch to be used only to complete a good gridiron, and in no case in blocks 600 feet or more in length.

b. For important mercantile and manufacturing districts, 8-and 12-inch; the former to be used only in sections where they complete a good gridiron and the latter for long lines not cross-connected."

The further recommendation is usually made,

"That all 4-inch mains used for hydrant supply be replaced within five years."

A note attached to this recommendation reads:

"A gridiron system of mains of the sizes recommended above is satisfactory only when cross-connected at all intersections, free from dead ends, and with large secondary cross-feeder mains at frequent intervals."

The maximum allowable length of the smaller mains between supporting larger mains is dependent very largely upon the spacing of the 12- and 16-inch secondary feeders, and somewhat upon the initial pressure available. The maximum of 600 feet for a 6-inch pipe is intended to apply to the type of system most often found, with 12- or 16-inch mains 3,000 or 4,000 feet apart in either directions, and carrying such pressures that the total friction loss in the distribution system should not be allowed to exceed 15 or 20 pounds during maximum draft. There are some systems having secondary feeders not more than 1,500 or 2,000 feet apart, or with an unusually high initial pressure, where an unsupported length of 1,000 or 1,500 feet of 6-inch pipe will still be able to furnish adequate hydrant supply at pressure not too greatly reduced.

For pipe extensions into newly developed districts, where the gridiron, as well as the supporting system of large mains is likely to be incomplete for some time, a number of progressive departments are using 8-inch as the minimum size. Other cities have in years past adopted the contrary policy of laying 4-inch mains into new sections, on the theory that the demand would be light, and no larger size was justified, and with the result that as these sections became more closely built, it was difficult to secure an adequate system without replacing the smaller sizes. However, it is at present the almost universal practice to lay no pipe smaller than 6-inch for hydrant supply. A recent summary of the practice in 25 cities in New England, and New York shows only one where 4-inch is still being used; in most of them the 4-inch is gradually being replaced and in a few others there is none in service.

For mains in the distribution system, cast-iron is usually considered in a class by itself, both as to length of service and general reliability; it is, however, subject to occasional sudden and disastrous breaks, sometimes without apparent cause. Care is necessary in testing for defective pipes, both at the foundry and after laying, and many ruptures have occurred from a settling of the pipe line or from lack of care in avoiding high points of rock or hard earth in the trench, resulting in an uneven bed and unusual stresses in the pipe. In the attempt to find a material less liable to sudden rupture, the use of steel or wrought iron pipe has been advocated; for the separate fire main system in the City of Baltimore, installed in 1910, steel pipe was used, with special attention to eliminating impurities from the metal and securing an effective and durable coating for the pipe. Both these points are essential if corrosion is to be avoided. Kalamein pipe, which is essentially a galvanized pipe, has been used with considerable success in some Western cities; it has not the life of cast-iron but is not so liable to rupture. Wood-stave pipe has also been tried in some Western cities, and banded wooden pipe in some Eastern cities, but their use in distribution systems is not advocated by the water works officials who have had experience with it. About 20 or 30 years ago many systems in the East, especially in New England, were constructed of cement-lined pipe, which consists of a thin sheet of wrought-iron or steel, covered with cement mortar inside and out, and in some cases of two wrought-iron shells, with layers of cement between and outside of them. These pipes sometimes gave good satisfaction for a number of years, depending largely upon the quality of workmanship. In general, this class of pipe has been found unreliable and subject to more or less frequent breaks, usually because the cement lining was not water tight and the wrought iron has corroded and become so weakened that a slight shock has ruptured it. Trouble has also resulted from lightning discharges, which have, in some cases, ruptured a considerable length of pipe.

From a fire protection standpoint, the main consideration in respect to gate valves is to secure sufficiently good spacing so that it will not be necessary to close off an unreasonable length of pipe in case of accident or repairs. The recommendation in the National Board reports, that this length of pipe shall not exceed 500 feet in mercantile or manufacturing districts, nor 800 feet in other districts, is considered reasonable, since many of the systems reported upon have gate valve distribution at least as good as this. A properly designed and ruggedly constructed valve is, of course, essential to good maintenance and reliable service. To make sure that valves are in good condition and are left open after being used, systematic inspection should be made at least annually, and records kept of inspections and of all valves operated. A good illustration of the neces-

sity for this is offered by the results of an inspection by the water department of a certain large city a few years ago; of about 7,000 valves inspected, 49 were found closed, 300 partially closed and 100 were either not shown on the plans or were not in the ground. In another case, a serious shortage of water at a rapidly spreading fire was discovered to be due to a closed gate. In some cities care has not been taken to secure gates all opening in the same direction, with the result, especially when no proper records are kept, that gates supposed to be opened have been closed. In one city of about 30,000 population, the fire flow tests conducted by National Board engineers showed a drop in pressure much greater than was anticipated. There were two mains, a 16-inch and a 12-inch, extending from the pumping station to the mercantile district near by, with connecting lines crossing the street between the two mains; there should have been an adequate quantity of water available with a loss of head of 15 or 20 pounds, whereas a less discharge resulted in a loss of head of over 80 pounds. It turned out that a valve on the 16-inch line and two on the connecting lines were closed, although supposed by the water department to be open; they operated in the opposite direction from most of the others in the system and had been closed for no one knows how long, with little likelihood of the fact being discovered except by some such tests as were made.

Hydrants should be of such dimensions and design as to pass adequate quantities of water with reasonable loss of head, should be sufficiently well distributed to permit of the maximum number of streams required to be concentrated on any fire without hose lines of excessive length, and good condition should be assured by frequent inspection and repairs when necessary.

Comparatively few fire departments attempt to supply more than one engine, serving an average of two hose lines at a hydrant, or to use more than two direct hose lines from each hydrant; for this service, which means a flow of 500 or 600 gallons per minute, the use of a hydrant with 5-inch foot-valve and 6-inch barrel and branch will result in a total friction loss of not more than 3 pounds, and this figure may be taken as a reasonable maximum loss under maximum draft from any hydrant. Smaller dimensions than those noted above may be allowable for hydrants on small systems or in scattered residential districts, but in general no 4-inch hydrants nor connections to mains should be used, and it is often worth while to replace 4-inch connections, especially if more than 10 or 12 feet long.

A study of hydrant spacing in most of the large cities of the country has led to the conclusion that the area served per hydrant is a better index of the protection afforded than is the linear spacing or distance between hydrants. This is so mainly because of the difference in the size and shape of blocks in various

cities. An area divided into large blocks will require fewer hydrants to secure a given linear spacing than if the same area is divided into small blocks, even though in the former case the fire hazard and the necessity for good hydrant distribution are greater.

The quantity of water required for any district having been fixed upon, proper hydrant distribution may be best determined from a sketch plan of such a number of hose lines as are necessary to care for this quantity; a consideration of friction losses in hose indicates that for anything like effective service no hose line should exceed 600 feet in length if from a fire engine, nor 500 feet if direct from a hydrant, unless the hydrant pressure considerably exceeds that usually found where direct hydrant streams are depended upon. Considering the number of streams usually taken from any hydrant, most high-value mercantile and manufacturing districts will require at least one hydrant to each 40,000 to 80,000 square feet of area and ordinarily well built-up residential districts one hydrant to each 100,000 or 120,000 square feet; the requirements will vary between the limits named, depending upon the total amount of water needed, and upon whether direct hydrant streams or fire engine streams are used. As good or better distribution will be found in many of our larger cities, and in the case of mercantile districts corresponds roughly to a linear spacing of 150 feet, and in residential districts of 300 feet. For each mercantile block 400 by 300 feet, center to center of streets, there should be at least three hydrants, probably located to the best advantage two at each street intersection and one intermediate hydrant on the long side of the block.

Hydrants in poor condition are most often the result of indiscriminate use for other than fire department purposes. This results in worn operating nuts, worn and battered threads and leaky foot-valves; this latter trouble is probably responsible for most frozen hydrants, since a hydrant with a tight foot-valve and proper drainage will seldom be found frozen.

Reasonable fire protection requirements will vary with structural conditions and with other features affecting the conflagration hazard, and to some extent with the fire department strength of the city under consideration and of its neighbors. Population is naturally not always a fair guide, but on the whole appears to be the best meausre for the approximate quantity of water necessary. Reports issued by the National Board recommend a minimum of 1,500 gallons per mintue in residential districts, and for high value districts a quantity approximately equal to $1{,}000 \sqrt{x}$ where x is the population in thousands. These quantities are considered to be perhaps 50 per cent. in excess of what may actually be used through hose lines; the 50 per cent. allowance is intended to take care of the loss through broken service connections to buildings burned during the early stages

of a bad fire, and will enable normal pressure conditions to be maintained for a time at least, so that the fire department may not be hampered by lack of pressure as long as there is a chance to control what might develop into a conflagration. During most of the conflagrations of which an estimate of the amount of water used has been possible, the maximum used on the fire and wasted through broken services and hydrants left open has been far in excess of what any of these systems may reasonably be expected to deliver while still maintaining normal pressures. At Salem, for instance, the maximum was at the rate of nearly 18,000 gallons per minute, nearly three times the amount called for by the above requirements; this quantity was of course delivered at very low pressure, and was only possible because of the emergency connections to the systems of adjoining municipalities.

To determine the pipe sizes necessary in designing a new system, analytical methods must be used, with certain assumptions as to the effects of tuberculation of mains and other friction producing elements; the same method may be used in determining the capacity of an existing system, but the results will be at best very approximate and actual flow tests from hydrants will give much more satisfactory and reliable figures.

The method of conducting such tests as practiced by the engineers of the National Board of Fire Underwriters is a development of the scheme of measuring discharges from smooth-bore fire department nozzles by means of the Pitot tube and gage, originated by Mr. John R. Freeman and now used by the National Board in its tests of fire engines.

It is possible to measure hydrant discharges with much greater accuracy by the use of short lines of hose and large nozzles than from open butts; however, in cities where the normal hydrant pressures are low, only a small part of the total quantity available for engine supply may be obtained in this way, and much more time and labor is consumed than when open butt discharges are measured. For these reasons, and in order that a representative number of tests might be made in a reasonable time in the various cities reported on by the National Board, the present scheme was worked out. It is believed that the results obtained will show not more than 5 per cent. of error.

The number of hydrants in a group, all of which are opened simultaneously, varies from 3 to 6, or even more in exceptional cases, depending upon the quantity of water available, the pressures and the character of the district in which the test is made. It is usual to open all available outlets on the hydrants used; however, if the pressures are high enough to furnish effective streams direct from hydrants, it is better to open only enough outlets to lower the pressure in the mains to a figure assumed to be the minimum consistent with good fire service,

which will range from 60 to 75 pounds or more, depending upon the character of the districts.

The pressure in the mains before and during the tests is determined by attaching a gage to a hydrant preferably located near the center of the group to be tested; it is sometimes advisable to have another gage at a hydrant outside the group, to determine the loss of head in the main arteries, or a recording gage located near the center of the distribution system may serve the purpose for a number of groups. Knowing the loss of head due to ordinary consumption, and the additional loss due to the measured flow from hydrants, a close approximation may be made of the quantity available at any given pressure.

Hydrant outlets, especially the large ones, are often not completely filled by the stream; the area of no flow is almost always a segment in the bottom of the outlet, of varying height depending upon the design of the hydrant and somewhat upon the velocity of the stream. Any projection into the waterway, such as the end of the stem of an independent valve or a roughness of the nipple, will also produce small "holes" in the stream. The area of no flow is in most cases fairly well defined, and the shape of the "hole" is sufficiently uniform to enable its proportion to the total area to be determined by measuring its height with a rule; for instance, with 4½-inch outlet, a "hole" 1 inch high forms 10 to 12 per cent. of the area of the outlet, a 1½-inch hole 20 to 25 per cent., and so on.

In determining the average velocity of the stream issuing from the outlet, the Pitot tube is moved throughout the area, and the observer will soon train himself by this traverse to fix upon a substantially accurate average; readings noted at the center and near the ends of the horizontal and vertical diameters will usually suffice, and the center reading in a small outlet is in most cases very near the average for the whole area. Readings should not be taken closer than ¼-inch to the sides of the orifice, since there is a noticeable retardation of velocity caused by friction against the walls of the hydrant nipple. This retardation necessitates applying a coefficient of discharge, which has been determined by careful experiments to be about 0.90; this is to be applied after allowance has been made, as above noted, in the case of outlets not completely filled by the stream.

The Pitot tube used in determining discharges from hydrant outlets has a straight blade about 4 inches long, which is threaded into one end of a piece of ¼-inch brass pipe 8 or 10 inches long on the other end of which is screwed the gage by which the velocity of discharge is determined. The gage which appears to be best suited for this work is 3-inch, graduated in half pounds from 0 to 50 pounds. Such a gage may be read easily to the nearest quarter pounds; corrections should be made as indicated by calibrations before and after using, either by means of a weight tester or by comparison with an accurate test gage.

Fire flow tests made as described above, have been made by National Board engineers in more than 250 cities throughout the country; this method has also been adopted by a number of water departments and private companies. It has proved to be very useful in determining the quantities of water available for fire protection and the sizes of mains necessary for proper reinforcement, as well as to detect abnormal conditions such as closed valves or other obstructions in the mains; it is believed to be the easiest and most reliable method of making the determination which may be considered final in any system, i. e., its ability to deliver water at the hydrant outlet.

Public Fire Departments

BY

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Fire department organization, equipment and operation naturally possess a vital interest for the insurance companies. In fact, some of the first fire brigades were organized and supported by them, being taken over later by the municipality, in accordance with the idea that the service was for the common good, and should be supported by all, insured and uninsured alike.

Of an importance which increases with the growth of a community and of the values involved, is the form of the organization of the fire department. In times past, practically all departments were volunteer organizations, survivals of the day when a few men would organize for mutual protection, with little regard for the property of others unless forming an exposure of their own. These volunteer departments, in the larger places, have mainly given way before the demand for better trained men and more prompt and efficient work. The next step forward was a part paid call system, with or without some permanent men paid full time; this system has been extensively used in the New England States and has given excellent service. However, the call system is being rapidly replaced, especially in the larger places, by full paid permanently employed departments. The reasons for this are somewhat the same as those for discarding the volunteer system. For example, an alarm of fire calls out many workmen, causing a loss to their employers with seldom any direct benefit; the objections of the employers make it harder each year to obtain good men for the fire service. The recent introduction of automobile apparatus has so increased the speed of response that unless men are at the station they cannot respond with the apparatus and their delay in reaching the fire is still more pronounced; discipline cannot be as well maintained and drills are not as complete nor as often held, with a consequent lack of efficiency in the departments; last, but not least, a call or volunteer organization does not readily lend itself to fire prevention work, as does a paid department. Further consideration will be given some of these items, as being of first importance in securing the highest department efficiency.

In fire departments, as in other branches of city government, political domination and petty graft have prevailed at various times. It goes without saying that the appointment of officers and men for other reasons than their fitness for fire service will almost inevitably result in demoralizing the force and decreasing its efficiency; probably the most serious effect is obtained when political debts are paid in the appointment of chief officers. Only men of proven ability should be given important positions; in some cases, competent chief officers of the smaller departments have been appointed to similar positions in the larger cities, and this scheme has worked out well. For all officers, long tenure of office is desirable, to secure proper familiarity with local fire conditions and the general duties of the position; to obtain this, as well as to eliminate harmful political changes, the appointment of all officers for indefinite terms, with removal only under charges, is desirable. The method of appointment best adapted for any city depends largely upon the size of the city and local conditions. Civil service methods have been in some cases rather freely criticized, but it is doubtful if anything better, or in fact as good, could be substituted. Where civil service is properly applied, the past record of applicants is considered and they must successfully pass a rigid physical examination before taking the mental examinations. While the mental examination may bar out some otherwise desirable applicants, yet in the large cities there is no lack of applicants and it is readily practicable to make physical requirements such that all the men getting on the eligible list shall have the making of able-bodied firemen. The varied emergencies and requirements of modern fire department work are best met by men capable of passing reasonable mental as well as the physical examinations, rather than by men whose chief asset is mere strength.

When the eligible list is established, appointments should be made by the chief rather than by a council committee or the mayor, and appointments should not be made permanent until the officers have had opportunity to observe the work of new men at fires and determine whether they will make successful firemen. Once appointed, they should be made secure in their positions during good behavior and efficient service.

For retirement, the National Board has recommended that members be retired from active duty on reaching the age of sixty-two years, unless at that time they are unusually efficient. Sixty-two years is the age for retirement from the United States Army and Navy. The exemption from this rule of members of unusual efficiency enables the department to avail itself of the accumulated experience of the higher officers, who should have no manual labor to perform. In connection with requiring members to retire on account of age, there should be provisions for pensioning men for long service or disability.

In the ordinary full-paid department, the men will be collected in a comparatively few companies of sufficient strength to man all the apparatus at the station. If call men or volunteers are included in the department, then enough full-paid men should be assigned to get the apparatus to a fire and get to work. In a part-paid engine company, for instance, the engineer, two drivers and one other member, preferably the captain, should be full-paid, so that at least two men will be on duty during meal hours, enough to get the apparatus to the fire; for a hose or ladder company, at least two men must be full-paid. This does not allow for days off or sickness, for which permanent substitutes should be employed, who will shift from one company to another to fill in.

For a full-paid department, the National Board recommends that at least seven men be present at all times in each engine and ladder company in mercantile and manufacturing districts and five men in other districts. For hose companies the men should number at least five and three, respectively. In an engine company the men will be as follows: engineer, one officer, two drivers and three hosemen. With a motor pump only six men will be required as the minimum on duty at all times.

In some departments the drivers are allowed to stay idly with their horses while the few hose-men struggle to carry hose up stairs and ladders. This is obviously poor practice but has been a difficult one to overcome.

The requirement of seven men present at all times in important engine companies may appear low; on the contrary it is rather higher than obtains in many cities, as men get ten to fifteen days annual vacation, four to seven days off per month, and three or four hours for meals. Consider a fourteen-man company, where men get two weeks' vacation, one day off in five and three hours daily for meals, a common arrangement. During a large part of the time one man is on vacation and three on days off, leaving ten on duty for the day; then during three hours the company is reduced to six men and during six hours to seven men, if men go in three shifts.

The movement for organizing fire departments on the two-platoon or two-shift plan has attained considerable strength. In cities where the actual day strength of companies is about one-half the paper strength, the two-platoon plan would apparently not appreciably decrease the effective force, and it appears that the total strength available for serious fires may be even greater than with the single-shift plan, if proper provision is made for their notification and response on second and greater alarms; objections raised by fire chiefs to the two-platoon system are mainly that discipline will be affected and that the men will be in poorer condition for the service, particularly those on night shift. There may be considerable force to these objections in departments where conditions render it difficult to maintain

discipline in any case; by a strict enforcement of the rules, as in Omaha, in which city the two-platoon system has been in existence since 1907, they appear to have been mainly eliminated. More serious objections are the lack of men for inspection work and the increased cost of such a system, amounting to about one-third more than the single-shift system; this last may result in a decrease in other expenditures desirable to meet the natural growth of the city.

The number of paid men per thousand of population in the larger cities of this country averages about 1.25, ranging from 0.75 to 1.5, depending upon the density of the population, the extent of the high values to be protected and the financial condition of the city. These men are organized in companies having about 12 members, either for an engine company or a ladder company, with usually only one or two companies in a house. An interesting comparison on this point is the practice in Europe, where companies are grouped; the County of London has a fire force of 1,365, for a population of 4,873,000, or a ratio of 0.28 per thousand of population. These men are organized into a total of 82 companies, with an average of 16 men per company. Similar figures for Berlin, Germany, show a total of 1,040 men, organized into 20 companies, for a total of 2,123,000, population with a ratio of 0.49 per thousand population and 52 men per company. For Milan, Italy, the figures given show a fire force of 221 full paid men, organized into 6 companies, for a total of 580,000 population, with a ratio of 0.38 per thousand population and 37 men per company.

Since the salaries paid in this country are much higher than those paid abroad, the per capita cost for maintenance is still further out of proportion. The salaries paid the various grades of firemen in the larger cities of the United States range from $900 to $1,400 a year and the per capita expense will average over $1.50 with a maximum of over $2.50. In London, the yearly pay will range from about $300 to $450, with clothing in addition; the per capita maintenance expense of the fire department is 27 cents. In Berlin, Germany, the per capita expense of maintenance is 26 cents, and in Milan, Italy, about 29 cents.

In considering the number and location of companies, the topography, street paving and general character of the city must be considered; Pittsburgh and Cincinnati require a considerably larger number of companies than do some other large cities not having such steep grades and more compactly built. The introduction of automobile apparatus has offset some of the disadvantages resulting from uneven topography and also influences the number of companies through making aid from surrounding communities more readily available; in this last respect it is considered that any needed department strength, over that necessary for proper local distribution, which must be

provided to handle a serious fire in the congested value districts may be offset to a large extent by the outside aid available within 30 minutes.

For proper quickness in response it is estimated that with automobile apparatus, an engine or hose company should be within three-quarters of a mile of every point in high value districts and a ladder company within one mile; in residential districts about twice these distances will give satisfactory service; for horse-drawn apparatus the distances should be two-thirds those given above.

The equipment for a department is largely dependent upon the topography of the city, the character of the buildings and condition of the water supply. Where the water works system is so designed as to supply an ample supply of water at a minimum hydrant pressure during draft of seventy-five pounds or over, the fire department can be kept upon a direct hydrant stream basis until buildings of over four stories begin to be numerous. One or more engines in service or in reserve may be desirable to protect the higher buildings or those too far from the hydrants for effective hydrant streams; for cities of over 30,000 population, it is advisable to have about one-third the companies provided with engines, to furnish the more powerful streams. Frequently some of the residential sections will be at considerably higher elevations than the business district and companies in these localities must be equipped with fire engines.

Chemical apparatus should be the main reliance for ordinary fires; in some cities, 75 per cent. or more of the actual working fires are controlled by chemical streams. In recent practice the automobile combination chemical and hose wagon has been found an exceedingly valuable apparatus and is largely superseding both the horse-drawn combination wagon and the straight chemical.

Steam fire engine construction has become quite well standardized and these machines have reached a comparatively high degree of reliability. However, the application of the gasolene motor to fire service offers such advantages that in the past year or two comparatively few steam fire engines have been sold, and many of these have been equipped with motor tractors to replace horses.

The earlier types of gasolene pumping engines were adaptations of touring cars or commercial trucks; the hard service required of such apparatus in pumping and in running over all kinds of roads, often in the hands of men poorly trained for the service, introduced conditions more severe than the machine could withstand. The defects developed by these earlier pieces of apparatus are being gradually eliminated by a careful design along the special lines necessary for such service.

In regard to the pump, for all except village service, two good fire streams should be available under ordinary working

conditions, which, with the modern use of hose with smooth lining and nozzles of good size and discharging capacity, means an actual delivery of about 500 to 600 gallons. With all pumping apparatus the slip may be expected to increase with use and other conditions will tend to reduce the capacity of the pump, so that a capacity of 700 gallons is not too much for most cases, and for metropolitan service even larger capacity may be desirable. City service at serious fires, when the maximum engine capacity is needed, will most often call for such lengths of hose lines and sizes of nozzles as to require an engine pressure of 120 to 150 pounds, with pressure up to about 200 pounds or more for fires in high buildings or for suburban service.

Various types of pumps have been used, and there are a number of different methods of connecting the pump to the engine. The types in use include reciprocating piston pumps, both single and double-acting, rotary cam or gear pumps, and pumps of centrifugal or turbine design, either of multi-stage or with two or more single-stage pumps working in series. Machines embodying each type of pump have been successfully developed. Reciprocating pumps usually require a more complicated power-transmission system than the others, and to work successfully with the range of pressure desired, have been provided with transmission permitting two speeds; this type of pump is, however, reliable, efficient and easily kept in good condition, if properly designed and given competent attention. The rotary pump, because of its compactness and the simplicity with which power may be transmitted to it, is well adapted to this service; some of the early makes, however, were not well designed for efficiency, and others were not able to operate at high pressure; the wear resulting from service, unless properly cared for in the design, will occasion high slip and impair efficiency.

Although used extensively in Europe, the centrifugal pump was not at first successfully developed for the extreme range of fire service required in this country. Though handicapped to a slight extent by the need of some special priming device to secure suction for the pump, the advantages of this type of pump were sufficiently great to interest several designers, and one fire apparatus manufacturer has adopted this type as its standard; its ability to withstand hard usage, its simplicity and ease of repair and its property of automatically regulating discharge and pressure are features tending to make it a most desirable type for fire service.

With any type of pump, the requirements desirable for fire service are flexibility of operation, that is, ability to operate over a wide range of pressure and the power required for good fire fighting; the National Board has recommended that the test be such as to obtain the full rated capacity of the pump for two hours against a net pressure of 120 pounds and one-half

of the rated capacity for one hour against a net pressure of 200 pounds; in some cases this last clause is changed to provide for a half-hour run at one-half capacity and 200 pounds net pressure and a half-hour run at one-third capacity and 250 pounds net pressure.

There are a number of automobile pumping engines now on the market which compare well in point of reliability with the steam fire engines, but there are other makes which have not passed the experimental stage and have not proved their ability to operate successfully for long periods and under the varying conditions of fire service.

The ideal equipment for an engine company in a city able to afford it consists of two pieces, a pumping engine and combined chemical engine and hose wagon, the latter ordinarily known as a combination wagon. A good arrangement in small or medium sized cities is to have about half the companies equipped as above, which will furnish adequate chemical service, and the other half equipped with combined pumping engine and hose wagon. This latter piece of apparatus must, of course, be so manipulated at a fire that after the one or two hose lines needed are stretched from the hydrant to the burning building, the engine will reach the hydrant and connect its suction as quickly as possible; there will naturally be somewhat more delay than if a separate engine and hose wagon are provided, but this delay should not be more than two or three minutes in most cases, even when two lines of hose are laid, as shown by tests of a crew trained to the work.

The triple combination, as it is usually called by manufacturers, consists of a combination of pumping engine, chemical tank and hose body. Most fire chiefs are agreed that this piece of apparatus is not a desirable one for general installation, for the obvious reason that its use in furnishing chemical service precludes its pumping from a hydrant or other source of water supply, at least without considerable delay at what is likely to be a critical moment; and also for the further reason that too much equipment is carried on one set of wheels and is lost to service in case of disablement. However, it has a place in localities where the pump is very seldom needed, as for instance, in cities where the water pressure is sufficient in most sections for effective direct hydrant streams, but there are occasional high elevations or weak spots on the water distribution system and the ordinary hydrant pressure is inadequate. It will also take the place of a reserve engine for use at serious fires in high value districts.

The main points to be considered in purchasing automobile hose wagons are believed to be covered by the recommendation included in most of the National Board reports, as follows:

Automobile hose wagons to have divided hose bodies with a capacity of at least 1,000 feet of hose when carrying equal

amounts of $2\frac{1}{2}$-inch and 3-inch hose. Motors to be capable of attaining a speed of 30 miles an hour, and of covering 20 miles in an hour over paved or macadamized streets having such grades as the apparatus is likely to encounter in service.

Most of the earlier automobile fire apparatus was fitted with pneumatic tires, and some of it is still so equipped; but some form of solid or cushion tire has come to be considered by most fire chiefs and manufacturers as preferable, from the standpoint both of safety and economy.

The question of hose is often one requiring considerable argument on the part of the chief to convince the city fathers of the need of money for an adequate supply; in addition to the hose on each wagon in service, a complete extra shift should be provided at each house in order that after use it may be shifted, cleaned and dried. If not used, hose should be shifted on the wagons at least every two weeks, in order to prevent mildew and cracking of the lining.

In case hose is burned or otherwise destroyed, or for large fires where wagons must come back to reload, the reserve hose is also needed. Investigation shows that the average hose lines in city fire department practice are somewhat over 400 feet in length; therefore, to provide two average lines each wagon should carry about 1,000 feet of hose. For wagons accompanying large engines able to pump over 800 gallons, or for outlying districts where long lines are common, 1,200 to 1,400 feet are better, making three ordinary lines or one long line for places at a distance from hydrants.

Good quality hose should have a life of about 7 years, and annual purchases should be made on the basis of replacing all hose every 7 years. That over 5 years old should be transferred to the outlying companies, so that in sections where a burst line would have serious results there will be only new hose.

The $2\frac{1}{2}$-inch hose is best adapted for regular use, but if long lines are laid or large streams required, the 3-inch size is better. With a standard $1\frac{1}{8}$-inch fire stream flowing, the friction loss in good $2\frac{1}{2}$-inch hose is fifteen pounds per 100 feet. Thus with 800 feet of $2\frac{1}{2}$-inch hose, 120 pounds pressure is needed to overcome friction and 45 pounds for the nozzle pressure, so the engine must work at 165 or 170 pounds. If hose is attached to a hydrant, the pressure is limited probably to 80 or 90 pounds and larger hose or more lines, siamesed, must be used to produce a stiff stream. Three-inch hose will convey the same quantity of water over two and one-half times as far as $2\frac{1}{2}$-inch hose, with the same friction loss; for a standard $1\frac{1}{8}$-inch stream with 800 feet of 3-inch hose only 94 pounds pressure will be needed at the engine or hydrant. By laying two lines and siamesing into one near the nozzle, the friction loss may be still further reduced, to about one-fourth the loss with a single line. In other terms, 108 pounds engine pressure will push a 250-gallon

$1\frac{1}{8}$-inch stream through 400 feet of $2\frac{1}{2}$-inch hose, or 1,000 feet of 3-inch hose, or 1,500 feet of $2\frac{1}{2}$-inch hose siamesed. Three-inch hose is heavy and stiff and not adapted for ordinary use in buildings or on ladders, so the best practice is to arrange the hose in wagons in two sections so that the 200 to 300 feet next the hydrant shall be 3-inch and the rest, which may have to be moved about, shall be $2\frac{1}{2}$-inch. The National Board has made the following recommendations: That each hose wagon shall carry at least 200 feet of 3-inch hose for outside leads. For high value districts, that eventually each wagon shall carry equal amounts of $2\frac{1}{2}$ and 3-inch hose, in two sections.

Where $2\frac{1}{2}$ and 3-inch hose are in use it has been found a great convenience to equip the 3-inch hose with $2\frac{1}{2}$-inch couplings, in order to eliminate delays from mislaid reducers and varying couplings. Contrary to general impression, the use of smaller couplings does not appreciably affect the friction loss, so that for ordinary fire streams the difference in pressures from straight 3-inch hose or 3-inch hose with $2\frac{1}{2}$-inch couplings is not noticeable. Therefore the National Board has recommended that both $2\frac{1}{2}$ and 3-inch hose be equipped with $2\frac{1}{2}$-inch National Standard couplings, properly beveled.

Annual tests of all hose over two years old, and of any others that show defects, should be made, with a test pressure of 200 pounds.

For use at serious fires, where additional lines are needed, many departments maintain their spare hose rolled and ready for quick loading on any wagon which may be sent back for it. Of greater value is a loaded reserve hose wagon, preferably carrying 3-inch hose, kept in some fire station centrally located with respect to the high value districts. This wagon should have a turret pipe, to give powerful streams; and in addition to this, a sufficient number of other apparatus should have turret pipes, deluge sets and cellar pipes to permit the use of a sufficient number of good streams to hold a spreading fire.

Cities having buildings over four stories high must make some provisions for fighting the fires in the upper stories. The use of building standpipes for this purpose, either from the lower floor of the same building or from a building across a court or narrow street, is recognized as being good practice, but in addition to this some apparatus must be provided for use where standpipes are not available. In smaller cities, a ladder pipe attached to the aerial ladder gives good service, and if equipped with 3-inch hose for the ladder lead, with a siamese at the lower end, streams up to 2-inch can be used, if the ladder is provided with a proper locking device. For the larger cities a water tower is necessary, and in some cities such apparatus is called on first alarms; its response should be provided for on the running card in every case, and frequent drills should be had with it to familiarize the men with its proper handling.

Extensive minor equipment is a necessity for any up-to-date department; in general, most of this is carried on the ladder trucks, as it is the duty of the ladder men to use it; however, hose wagon equipment should be sufficiently complete to permit the men on the wagon to work independently of the ladder trucks for all residential and other small fires. Besides a complete set of nozzles, including both shut-off and open tips from $\frac{7}{8}$ to $1\frac{1}{4}$-inches in diameter, suitable forcible entry tools, chemical extinguishers and short ladders should be carried on each hose wagon. Ladder trucks and most of the hose wagons should carry salvage appliances, particularly waterproof covers.

The question of suitable fire stations does not ordinarily affect fire service directly; poor arrangement for the apparatus, narrow streets in which to turn out and improper locations of sliding poles, etc., are features sometimes found. Unsanitary arrangements and dilapidated buildings affect the health and spirits of the men to a certain extent and should be corrected.

Repair facilities are necessary for the proper upkeep of apparatus, particularly in the larger cities where apparatus gets considerable use. It is better to have this handled by the department, and in many places all minor repairs are made by the men while about the house. A good supply of spare parts is becoming of great importance with the general use of automobile apparatus. To take the place of apparatus being repaired, it is necessary to provide a certain amount of spare pieces, and this is also of greater moment with a department equipped with automobiles. It is estimated that provisions should be made to have at least one fire engine out of ten in reserve, with one out of five for automobile pumping engines; for hose wagons, the number in reserve would be one in fifteen and one in ten, respectively, for horse-drawn and automobile.

In the purchase of new apparatus, particularly pumping engines, adequate tests should be made, and similar, though not so severe, tests of repaired apparatus. For pumping engines, these tests should be along the lines of those conducted by the engineers of the National Board of Fire Underwriters. In these tests, each engine is run for twenty minutes or more, under such conditions as would be met with at a serious fire; the speed is noted and actual discharge measured by means of Pitot tube and gage. By means of this test, there may be determined the capacity and condition of the engine, the ability of the engineer and the quality of the fuel, and the value of the test consists largely in demonstrating to fire department officials the actual condition of the engine and the best methods of correcting such defects as are disclosed; such tests have so commended themselves to a number of fire departments as to be adopted as part of their regular operation. A pamphlet has been issued by the National Board describing methods of

testing and appliances necessary, and copies of this pamphlet have been distributed to members of fire departments all over the country.

This pamphlet contains also tables showing friction loss in hose, and the pressures necessary at engine or hydrant to maintain given nozzle pressures with various lengths of 2½ and 3-inch hose. These tables demonstrate strikingly the futility of long lines of 2½-inch hose and the advantages of using siamesed lines and 3-inch hose where heavy streams are required.

Discipline greatly affects the general condition of a department and is in itself greatly affected by political influence in many cities; semi-military discipline is usually exacted, including proper deference to superior officers. In volunteer departments the lack of discipline is very noticeable and often results in serious loss; fortunately it is rather uncommon for the lack of discipline to be so marked today as in the past and resulted in companies fighting each other instead of the fire.

The required response of apparatus to any fire also depends upon the character of the city. In general, every alarm should be considered as indicating a serious fire, and the response made accordingly; in many cities, only one company is sent to answer a telephone alarm, the chief arguing that in nearly every case such an alarm has been for a fire which could be handled by one company and that it is not well to send more apparatus than is needed. This contention is obviously erroneous, as alarms for many extensive fires are first sent in by telephone. As a general rule, at least two engine or hose companies should respond to every alarm of fire, not only because both may be needed immediately upon arrival, but also to offset the probability of no apparatus arriving because of an accident. In high value districts, as values and congestion increase, the response should be strengthened; in New York, to many of the down-town boxes, five engines respond on first alarms, and an average of four for each succeeding alarm. One or more ladder trucks should be sent to all sections having buildings which cannot be reached by the ladders on the hose wagons. To get a uniform response, a properly prepared running card is essential, with provisions for companies to fill in vacated houses or cover territory left without apparatus. It sometimes happens that response may be too heavy, too many of the companies going out to leave proper protection against a second fire; this is particularly likely in a volunteer department.

No feature of fire department operations offers a more interesting field for study than those of drills and training and of fire methods; by means of the former the men are kept in good physical condition, and prompt and proper action is secured. A number of the best departments maintain drill schools where new members are sent for a regular course of

instruction, and details from the different companies drill at regular intervals to maintain their proficiency. It is recognized today that to enable proper drills to be held, a drill tower, equipped with the necessary appliances, must be provided.

The methods employed in extinguishing fires vary somewhat in different cities, and there is a wide variation in some respects between practice in this country and abroad. Herr Reichel, the head of the fire department of Berlin, Germany, has recently been quoted as saying that American fire departments are "extinguishing organizations, pure and simple;" and if this is so, it is largely because there are seldom any laws or ordinances which permit them to be anything else — to take up the other functions of fire prevention. the discovery and elimination of fire hazards and looking after the installation of devices to prevent the spread of fire. In some cities, a beginning has been made in this direction; in others, fire chiefs have been able, through personal popularity or the assumption of authority, to secure considerable improvements, even without the aid of adequate regulations, but this is hardly feasible in the larger cities.

The existence and continuance of conditions tending to produce a high conflagration hazard have thus made necessary the development of the purely extinguishing function. With the increase in extent and in hazard of high value districts, there comes an increasing demand for fire-boats and high pressure systems, to check the spread of serious fires and prevent conflagrations.

Nearly all fire departments use chemical streams to a greater or less extent, some of them from straight chemical engines, more often from combination chemical and hose wagons; these chemical lines, for use inside buildings, are backed up by lines of large hose, with shut-off nozzle or controlling nozzle to avoid water damage. For outside lines, 2½-inch and sometimes 3-inch hose is used, usually with 1⅛-inch or 1¼-inch nozzles. There is an increasing tendency towards the use of deluge sets, turret nozzles, and water towers for spreading fires, with nozzles 1½ to 2 inches in diameter, sometimes even larger. One of our engines is seldom expected to furnish more than two streams from 1⅛ or 1¼-inch nozzles, whereas the practice in some foreign countries is to run out from two to five lines from an engine of not more than half the capacity of an American engine. These streams are, of course, used inside and close to the fire where possible, and structural conditions and hazards tending to result in serious fires are comparatively rare; however, a comparison of statistics indicates that while the number of fires per thousand of population is very much less in Europe than in this country, the loss per fire in many foreign cities, most of those in Germany being notable exceptions, is as high or higher than in our own cities.

Salvage work has in the past been left largely to the insurance interests, but this, as well as fire extinguishment and fire prevention, is being taken up by some departments. Besides the steps taken to reduce water damage by the use of chemical streams and shut-off nozzles, companies should carry and spread covers to protect goods, and clean up after fires.

The fire alarm system has been properly called the right arm of the fire department, as the promptness and accuracy of its notification largely determines the extent of the fire. A brief description of the main features is therefore pertinent.

In 1851, the question of utilizing the inventions of Morse telegraphy for the sounding of fire alarms was taken up and apparatus invented by which tower bells could be sounded from stations distributed throughout the city. The modern fire alarm system has been developed from this beginning. The boxes contain clock-work which actuates a figure-wheel and is connected by an electric circuit to a headquarters or central office. Each box has its own number, which is transmitted through headquarters to the various fire stations and designates the locality of the fire. From headquarters, alarms are transmitted either manually or automatically. In the former case, the box number is received by operators at headquarters and sent out over circuits, distinct from those containing boxes, either by a Morse key or a special transmitter. This type of system is best suited to large cities where two fires are apt to occur at about the same time; or where a number of boxes may be pulled for one fire; accuracy and speed depend to a very great extent upon the operator. In the automatic system, alarms are transmitted, at headquarters, by a repeater which receives an alarm from a box on one circuit and sends it over the other box circuits, and in some cases over special circuits, to the various fire stations without manual intervention or assistance. This type of system is for use in the smaller places, where cost of maintenance is an important factor and simultaneous alarms are infrequent.

Proper design and maintenance require that every box alarm will be received at headquarters and recorded automatically. It is of more or less common occurrence for a number of boxes to be pulled for the same fire, or for alarms for two or more fires to come in simultaneously, either over the same or separate circuits; this condition, in connection with the above requirement, calls for rather complicated central office equipment, and for boxes of the type known as non-interfering and successive.

Fire alarm telegraphy is a specialized subject with which comparatively few engineers are familiar, but one which is at the present time receiving a much greater degree of attention than it has in the past, especially in a number of the larger cities where the increase of complications with growth has required special study.

Woodworkers

BY

H. E. BURDETTE

January 15, 1915

Last year I had the pleasure of reading a paper to you on the general subject of woodworkers. It is unfortunate that I selected that special hazard as this year's course requires that this particular subject be taken up, and those of you who plan to take the examinations for the second year work will be required to answer questions on woodworkers. On that account I have been asked to review the subject tonight.

The woodworking class is a large one, and includes such a number of sub-divisions that at best we could only touch upon it briefly in one evening.

To start in with, let us review hurriedly the more important points covered in last year's paper. I will state here that the lectures delivered to you last year are being printed, so I refer you to those papers for more detail.

You will recall that we divided woodworkers into two sections — hardwood and softwood factories. The working of hardwood is ordinarily less hazardous than the working of softwood, principally because the hardwood is more valuable, and therefore is handled more carefully.

In all Inspection Bureaux reports you will find among others, two headings; that is "*Common Hazards*" and "*Special Hazards*." Under "Common Hazards" you will find described the heating system, lighting system and power plant, including the boilers, engines, dynamos, et cetera. In last year's paper we included under this heading of "Common Hazards" the care of sweepings, oily waste, et cetera, whereas the Bureaux reports usually cover this under a separate heading such as Care and Cleanliness, or Housekeeping.

Under "Special Hazards" the Bureaux reports, you will find, give a description of the processes and hazards that are peculiar to that particular plant unless it is a report on a class of risk that is so common that the "Special Hazards" are known to all insurance men.

In all woodworking plants the "Common Hazards" such as lighting, heating, power (development and transmission) and care of rubbish and sweepings, the use of inflammable liquids, et cetera, are present.

The "Special Hazards" of woodworking establishments that are most common to all are the dry kilns or dry rooms, the disposal of refuse, including the shavings vaults, and the finishing hazards including especially the dip tanks.

LIGHTING: Extreme care should be taken to see that all lighting systems are installed by a competent mechanic in accordance with the rules laid down by the National Fire Protection Association and published by the "National Board".

The use of kerosene oil lamps or lanterns and the like, also the use of gas for lighting under ordinary conditions is not recommended as it is almost impossible to safeguard open flames in woodworking establishments.

Electricity is recommended and where electricity is used the incandescent lights are ordinarily installed. Where they hang from the ceiling there is danger of the bulbs being broken or of their resting against inflammable material. This would not ordinarily set fire to a flat wooden surface, but there is heat enough to char a wooden surface, and possibly under favorable conditions, to start a fire; therefore, proper guards should be provided wherever there is danger of these bulbs coming in contact with stock or being broken in use.

In a heating system the source of danger is ordinarily the contact of inflammable stock with hot metal surfaces. Steam is the ordinary means of heating woodworking establishments and a system properly installed with plenty of clearance where pipes pass through floors and partitions is comparatively safe. The point to be looked for and guarded against is the storage of stock against these steam pipes, assuming the system itself is properly installed. Quite often in the summer time when the pipes are not in use workmen will get in the habit of disregarding this danger and stock will be piled against the steam pipes; then in the fall these piles having become familiar objects are overlooked when the steam is turned on.

The same applies to the hot air heating systems. All inflammable materials should be kept away from the hot air pipes. The ordinary stove is now very seldom used as a method of heating in an up-to-date woodworking plant, but occasionally they are found, especially in the South where heat is needed only a few days in the year. This practice should be discouraged and an approved method of heating provided.

POWER: You will recall that the hazards of power development are principally those in connection with the boiler plants, the burning of the refuse which the factory produces, etc. The Dutch oven is a common form of boiler used in woodworkers where a large amount of refuse is produced. The shavings vault and dust collectors and the conveyor system for handling this refuse were fully discussed in last year's paper. The point to be guarded against is to see that the shavings vault is well cut

off from the balance of the plant and that the conveyor system is substantially erected, connected to all machines producing dust and refuse and where possible run over the roofs of buildings rather than through fire walls.

The hazards of transmission is principally that of friction between fast moving bodies with an accumulation of dust held on the machine by the oil used in lubrication ready to start combustion the moment the friction of the parts produce the necessary heat to produce combustion. In connection with saw mills, to which I will refer later, the refuse burners will be described.

This covers briefly the common hazards, and I refer you again to last year's lectures on "Common Hazards" for further detail, if wanted.

The Special Hazards of woodworking plants will now be described.

DRY KILNS

Dry kilns or dry rooms are found in nearly every woodworking establishment. Boards sawed out of green logs are run into the dry kilns at the saw mills where they are dried. This lumber is then shipped to the factory manufacturing — say, for example — piano cases. This lumber has collected more or less moisture and must be redried before it is in shape to be worked up for piano cases. Therefore, a piano factory, and in fact most factories working lumber have redry kilns or dry rooms. Under this same heading come the dry rooms for drying stock which has been glued together.

The dry kilns and dry boxes also sometimes called "Caul Boxes" are simply enclosures usually long and narrow varying in size and in accordance with the requirements of the particular plant. The stock is run into these rooms on racks or trucks on a track provided for the purpose. This track carrying the trucks is usually suspended a few feet above a system of steam coils which supply the heat for drying the lumber. In the construction of the walls and roof of the dry rooms or dry kilns various channels and passageways are designed to cause draughts which will carry off the moisture laden atmosphere produced in the drying of lumber so that dry hot air can be kept in contact with the stock as much as possible.

Many kilns and dry boxes do not have the steam coils in the rooms themselves, but the hot air is blown into the rooms from the outside.

The kilns with the steam pipes at the bottom or on the sides are the most common, and the danger here lies in the collection of refuse, splinters, dust, et cetera, piling upon the pipes and after getting "dry as tinder" having sufficient heat developed to start a fire. When a fire is started in a room of this sort you can readily understand that conditions are ideal for a quick

spread and the production of a very hot fire. Therefore, look out for the arrangement of your steam pipes or other methods of supplying heat and keep the places clean.

There are to-day on the market a number of patent dry kilns using live steam or superheated steam instead of hot air. The claims made by the manufacturers of these patented devices is that the wood is dried in a more natural way and a more uniform "*grain*" is obtained. They claim that with the old style of drying with hot air by steam-pipes the outer surface of the boards being dried, are hardened to a greater and unnatural degree. As a rule the designers of these patented kilns have taken into consideration the fire hazard, and I think it is safe to claim that they are safer than the ordinary dry kiln.

SHAVINGS VAULTS

These are usually built in connection with a power plant as a storage house for refuse material. Ordinarily the refuse consists of shavings and sawdust and is conveyed to the shavings vault through metal pipes from the machines producing the refuse by a current of air produced by a fan located somewhere in the system of pipes.

In addition to the danger of fire starting in this inflammable stock there is the dust explosion hazard which will be dealt with shortly.

The proper disposal of dust of any description is direct from the machine by which it is produced through well constructed smooth metal piping or conduits and exhaust fan, to a ventilated and screened centrifugal dust collector, preferably above the roof of the building, and thence to a proper receptacle, storage vault or furnace as required by the nature of the material. In woodworking factories the vault should be of heavy brick or concrete walls, smooth finished inside, with light non-combustible roof and with vault entrance at least twelve feet from boiler, provided with a standard vertical self-closing fire door. Chutes opening into vaults for disposal of shavings by hand from upper stories, if any, should be of brick or heavy plate iron, and provided with heavy fire doors closing by gravity against the interior of chute. Automatic furnace feeders require valves or dampers in the piping to properly control the feed to different fires and to divert the refuse to the vault when necessary. Dampers or check valves opening only in the direction of the air currents are not a sure preventive against "*flashback*", but where installed they should be so constructed that no clogging by an accumulation of waste material can occur. All dust and refuse collecting and conveying system pipes and conduits should be run direct, with few turns, and the passage through floors and walls should be avoided where possible, as a breakdown may carry fire beyond the limits of an area.

On the screen is shown a standard shavings vault built of brick, one story high with walls parapetted three feet or more above the roof of the surrounding or adjoining buildings. On the roof of the shavings vault is a cyclone dust collector. This apparatus is designed to remove the dust from the air allowing the dust and shavings that come through the pipe to settle in the center while the air escapes to the outside.

The only opening in an ordinary shavings vault is the small doorway for the removal of refuse. This doorway is usually cut in the wall separating the vault from the boiler room, and under these conditions it should be raised twelve or eighteen inches above the boiler room floor.

When firing by hand in a boiler room the fireman usually makes use of a wide fork with which he shovels up the sawdust in the vault and carries it to the furnace door. In doing so naturally a quantity of sawdust and shavings is scattered from the shavings vault door to the furnace door. Unless these scatterings are swept up there is danger in sparks from the furnace falling into them and then we have the condition of a train of fuel leading from the shavings vault to the boiler, but with the sill to the vault door raised a foot or eighteen inches above the floor an ordinary fire would not be big enough to lap over a sill of this sort.

The opening should be protected by a standard tin-clad fire door arranged to close automatically by the fusing of a link, and in addition this door should be kept closed at night-time or when the plant is not in operation.

For the protection of shavings vaults steam jets and automatic sprinklers are advisable. The arrangement of the steam jets with quick opening valves in the boiler room and the arrangement of the automatic sprinklers has been described in last year's lecture on Woodworkers.

DUST EXPLOSIONS

Most any organic substance containing carbon, hydrogen, oxygen or nitrogen, such as for example wood, cotton, et cetera, when ground into fine dust mixed with the proper amount of air and supplied with a spark or flame will produce an explosion. The dust explosions are said by chemists to occur in two stages; first, the ignition of the dust particles and instantly following the explosion of the gases formed by the burning of the dust. These phases follow in such rapid succession as to practically form one operation.

Explosions may occur at some distances from an open light or fire. The presence of open chutes, stairways, elevator shafts, et cetera, which allow clouds of dust to fill all the intervening spaces between the points of explosion and the flame will produce a flash back to the source of dust production. An atmosphere of dust may be in contact with a flame without an explosion

because the precise conditions are not present, but the moment the right conditions arrive the flames shoot through the mass with an ever-increasing energy and an explosion follows.

With the exception of coal, flour and starch, *wood dust* is probably produced in larger quantites and by a greater number of processes than any other organic dust, and at the same time it is handled more carelessly than any other dust. The necessity of its rapid removal to avoid congestion around machinery often makes its safe disposal a difficult problem, involving large outlay for dust collecting systems which in themselves are often responsible for fires and explosions that occur through friction of neglected and improperly lubricated fan bearings; from refuse fouling the fan blades causing friction, and from sparks being carried backward through conveyor pipes from boiler furnaces when the fan is not in operation. The breakdown of dust collecting machinery has been the indirect cause of explosions with loss of life resulting from efforts to dispose of dust and shavings by direct hand firing while the collective system was inoperative. Wood dust explosions have been caused by dislodging masses of shavings and dust from projections in the walls of the vaults, and the clouds of dust becoming ignited by open lights or furnace fires nearby. The "Hog", a machine consisting of a heavy iron toothed cylinder revolving rapidly within a strong casing, for the purpose of breaking up wood waste to facilitate disposal by the collector system, is a large producer of dust, and nails or other bits of iron striking sparks have caused serious explosions.

The dust from sandpapering machines being naturally very fine and dry, and as it is produced rapidly in large quantities, must necessarily be conducted to some receptacle by a blower system, and therein lies the danger of thorough diffusion with an abundance of air extremely favorable to rapid combustion.

The Millers Committee of Buffalo, N. Y., composed of the head officials of some of the large flour mills in the Country became interested in these dust explosions and secured assistance from the United States Government through its Bureau of Mines. An investigation was made of dust explosions in cereal mills, elevators and warehouses, and I quote from that report which is entitled "The Explosibility of Grain Dusts" the following hazards which will give you an idea of the small amount of dust necessary to produce an explosive mixture.

"Experience at the Pittsburgh testing station of the Bureau of Mines has shown that an explosion could be produced when there was only .032 ounce (thirty-two one thousandths—32-1000) of coal dust suspended in each cubic foot of air, or one pound in 500 cubic feet of air. In order to produce complete combustion it takes all of the oxygen in one cubic foot of air to completely burn 0.123 ounce (one hundred twenty-three thousandths) of the dust used. This dust was sufficiently fine to pass through a 200 mesh sieve (one with 200 openings in the length

of an inch) and floated easily on a strong air current. From these texts we might form a preliminary conclusion, viz., that when the mixture contains between .032 and .123 ounces per cubic foot it forms an explosive mixture, and one that is extremely dangerous. We might term these proportions the lower and higher explosive limits of the explosive coal dust mixture.

In the experiments of M. J. Taffnel at the Lieven experiment station in France, in one instance as low a weight as .023 ounce of coal dust per cubic foot of space was sufficient to produce an ignition. At the German station at Derne, an ignition was produced when .040 ounce of coal dust was suspended in one cubic foot of air.

These figures, as given apply to coal dust tests, and indicate that a very small amount of dust in suspension is sufficient to produce the original ignition that will propagate to a very disastrous explosion. Preliminary experiments already conducted indicate that many of the grain dusts have relatively a lower ignition-temperature than many kinds of coal dust; also upon ignition the grain dusts give higher pressures at lower temperatures than some of the coal dusts. This would seem to indicate the possibility of securing an ignition of dust of this nature, with a smaller proportion per cubic foot than is necessary for coal dust. This, however, has not been definitely determined, and will be a matter for future experiment.

Propagation of Dust Explosions

The investigations already conducted in connection with previous explosions indicate that usually two reports are heard by the men who have survived the ordeal and have been able to relate their experiences. The first report is described as a sharp, quick sound, followed by a second of a loud, rumbling nature, and lasting for a much longer period than the first report. The second report is usually followed by fire, destroying the plant and surrounding property. An explosive mixture, consisting of a very small quantity of fine dust in suspension, ignited by sufficient temperature would, no doubt, cause the sharp report usually heard first. This original ignition, possibly only an inflammation, would produce sufficient concussion to disturb the dust that is settled and packed on surrounding ledges and projections, and shake this fine dust into the air, making an additional explosive mixture. The heat, or flame from the original small puff, or inflammation, would cause an ignition of this newly formed mixture, and the explosion would propagate throughout a very large area, until the entire dust zone would be covered. This would probably account for the loud rumbling sound of long duration, accompanied by a large body of flame.

This establishes an important relation between the dust in a settled or packed condition and the amount of dust in suspension that is necessary to originate the explosion. Many theories

and ideas have been advanced as to the conditions under which dust explosions are produced and the amount of dust in suspension necessary to originate the explosion, all probably based on different tests and experiments. It is generally agreed that the dust must be fine and dry, and in a state of suspension in the atmosphere, which upon being brought in contact with sufficient heat or flame, causes an ignition. It is conceded that there must be a proper proportion in diffusion so that the explosive mixture of dust and air will ignite with sufficient force to propagate to an explosion.

CONVEYOR SYSTEMS

Nearly all machinery in plants of every description nowadays where dust is produced in the processes of manufacturing is equipped with a blower system. These blower systems are all operated on practically the same principle. That part of each machine which is producing the dust is surrounded as much as possible by a metal envelope which tapers off into a small metal tube from an inch or two in diameter up according to the amount of dust and the size of the machine it is connected with. Where there are two or more machines these pipes lead into a main pipe with a capacity a little in excess of the combined capacities of the branch pipes, and this main pipe then extends to the outside of the building or to its place of discharge. Somewhere centrally located is a large fan which, when in operation, produces a rapid air current through the system which results in the metal envelopes or hoods at the machines sucking in material unless too heavy for the air current into the system, and if this system is properly designed without obstructions this material is carried through and discharged.

Usually this dust is collected for convenience and cleanliness and the Cyclone Dust Collector is the standard now used. These dust collectors are usually in a woodworking establishment on the top of the shavings vault, and when the system is in operation by means of a set of dampers in the system of pipes this refuse material being handled can either be directed to the Cyclone Collector or switched to feed through other pipes direct into the boilers. As this system was described at length in last year's paper no further description is necessary.

In many woodworking establishments handling a large quantity of material and producing a large quantity of refuse, such as in box factories, veneer plants, et cetera, it is often necessary to have a conveyor system that will carry these blocks and ends of boards to the shavings vault, as of course, no blower system could handle them. Therefore, it is common to find in such factories a depression or trough built in the floor which is a long box-like affair in which runs an endless chain. Every few feet there is a cross piece either of iron or wood fastened at right angles to the

chain and being in length nearly equal to the boxed enclosure. With such a system arranged holes can be cut in the floor and by inclined chutes the refuse from the various machines can be fed into this conveyor which sweeps along the blocks and sticks to the power plant.

In saw mills where this refuse is of very little value and where more is made than can be burned under the boilers it is necessary to burn the refuse outside of the plant. There are two ways in which this is done. The conveyors in the mill discharge just outside of the building into a hopper which feeds the material onto a long conveyor usually at least two hundred feet long which runs to a slab pit, as they are called, where a fire is burning. This system continually drops the new refuse onto the fire, and in this way the waste is disposed of. To guard against sparks or fire being communicated back to the mill usually a brick wall is built in the shape of a wide V, and extending from twelve to twenty feet high.

The end of the conveyor trough next to the slab pit is built of sheet iron instead of wood, and in a properly arranged conveyor a stream of water plays on this metal conveyor and on to the chain as it returns to the mill. This water keeps the conveyor cool and it extinguishes any sparks or burning splinters that may have been caught in the chain and ignited while over the pit. This arrangement is more or less dangerous because in case of a high wind even with a brick wall sparks are apt to be blown to the mill property.

The other and safer way of disposing of this refuse is by means of a burner which is shown on the screen, and which was described in last year's paper. This slab burner consists of a cylindrical furnace of boiler iron with a dome-shaped wire screen spark arrester at the top. They run from ten to twelve feet in diameter and from thirty to sixty feet in height. In this design the heat generated is made use of in warming water which in turn is fed to the boilers, and therefore this burner shown has an outer cylinder of boiler metal extending up part way or to a point above where the greatest heat from the fire would be.

All of these conveyor systems designed for different purposes have as their object the removal of refuse from the plant and to assist in maintaining as high a state of cleanliness as possible. Care must be taken and personal ingenuity used to design the conveyors and operate them in such a way that they will not create a hazard in themselves greater than the refuse of poor housekeeping hazard.

FINISHING

After the woodworking processes have been completed and the stock put in its final shape it then has to be painted or varnished, and this is one of the principal hazards of woodworking establishments.

This finishing is done in various ways. The cheaper the goods made the less care is given to the painting and ordinarily toys, furniture and other cheap articles are painted by dipping the articles into a tub containing the paint, varnish or oil. After the articles are dipped of course they must be set away to drain and dry, and this method of painting constitutes what is known as the "*Dip Tank Hazard*."

The tanks are usually built of sheet metal or of wood metal-lined with the metal in either case soldered or riveted together to make the tank tight. Into this tank is poured a mixture consisting of oil, turpentine, or whatever is used, and extending from the edge of the tank out into the room is an inclined platform which is usually metal clad. This is the platform on which the articles are set to drip and dry. The purpose of it is to save as much as is possible of the paint or varnish, and also to make the cleaning up as easy as possible.

In some woodworking establishments I have seen dried paint on the floor from one to three or four inches thick in spots, and you can imagine what a fierce fire this would make once the building caught fire.

A dip tank properly arranged can be made reasonably safe. The tank should be of heavy construction and just as small as possible to accommodate the work. The tank should be emptied each night before closing time and the inflammable liquids removed to a separate house outside the plant used especially as a paint and oil house. Near the top of the tank there should be provided an overflow pipe which should be extended outside of the building and arranged to discharge into some place where no damage could be done to the surrounding property if it discharged burning liquids. A substantial close-fitting metal cover should be provided for each dip tank when the tank is not in use. The better way is to arrange this cover on hinges and have it held open by ropes counterweighted in which are fusible links.

When a dip tank takes fire it is almost impossible to extinguish the fire so that the only thing to do is to deprive the fire of anything to feed upon or to smother it out with its own smoke. A drain pipe at the bottom of the tank enables one to drain off the liquid at night, while in case of a fire the cover would tend to prevent a fire in the room outside of the tank igniting the liquid in the tank, or if the tank itself was on fire it would help smother the fire and keep it from spreading to the room itself. Probably these dip tanks are the main hazardous single feature in connection with finishing in woodworking establishments.

Painting or varnishing done by hand with brushes is not hazardous, and if care is taken to keep the floor and surroundings well cleaned after the work has been done so that an accumula-

tion of paint will not pile up there is no special danger from the volatile gases given off.

Recently a new form of painting and varnishing known as the spraying process has come into use. By the means of compressed air the liquid is sprayed onto the article to be painted, the object being to reduce the labor. This increases the quantity of inflammable vapors and is therefore more hazardous than painting by hand.

Where this operation is carried on arrangements should be made to properly ventilate the room so as to carry off these inflammable vapors or gases, and special attention should be given to the electrical equipment using keyless lights, et cetera, so that no sparks may be produced which would set fire to these gases.

In high grade work the wood has to be filled before it can be finished. This is accomplished by dipping the object into a tank containing filler liquid or by applying with a brush. This liquid usually consists of a ground mineral of some sort held in oil or some other liquid. This mixture fills the pores of the wood, and after drying to a certain extent the surplus is rubbed off by hand, using rags, cotton waste, sea weed, moss, et cetera for the purpose. Right here is where another serious hazard develops; that is, in the care and disposal of these oil-soaked waste rags or moss. As we have learned, spontaneous combustion readily sets up in any vegetable fibre material when saturated with certain kinds of oil, provided the proper conditions exist. Therefore, extreme care must be taken at all times to see that all of this material is removed at least once a day before closing and burned under the boilers. Self-closing metal oily waste cans should be provided as receptacles for this refuse.

After the filling has been rubbed down to as smooth a surface as possible the varnish is applied usually with a brush, but sometimes in cheap work by dipping. The hazard here lies in the use of materials of an inflammable and more or less volatile nature. They contain turpentine, linseed oil and other constituents. For high grade finish numerous coats of varnish are applied and one after the other they are rubbed down by using pumice stone and water or some similar material; this process is not hazardous. Quite frequently in connection with varnishing it is necessary to have a dry room and here you have combined the hazard of the dry room and the inflammable gases.

Water will not under ordinary circumstances, extinguish an oil or gas fire. Therefore, it is customary to use clean dry sand or chemicals for extinguishing these fires. It is also advisable to have pails of sand with small scoops handy with which to spread the sand in case of fire.

In the foregoing I have tried to give you what appears to me to be the hazardous features of woodworking establishments

and as they are common to most woodworking plants a good knowledge of these features and their methods, arrangements and protection will enable you to handle any special combination or arrangement which you would meet with in the innumerable combinations of woodworking establishments.

There is a pamphlet printed by the Rollins Publishing Company of Chicago which was written by Mr. S. H. Lockett, entitled "Woodworkers, Their Processes and Hazards." In this pamphlet, (which, by the way, sells for one dollar per copy) are listed alphabetically most of the woodworking processes, and each is briefly described with the hazardous features brought out.

I understand that other Institutes of this sort that are giving Courses this year are putting much more time on this subject, but as one period is all that could be given in the Course here this year, it has been necessary to skim over it as briefly as possible. I, therefore, urge you who are interested, and especially those of you who intend to take the examinations, to secure this pamphlet on Woodworking and read it, but I am sure that aside from the Special Hazards introduced because of their processes such as metal working in connection with the woodworking, as for example, in a billiard table factory you will find the Common Hazards and the Special Hazards which we have discussed are readily recognized.

I would like very much to have had time to take the log as it is prepared by the loggers in the woods, bring it to the saw mill and start it on its journey through the various factories, but lack of time prevents this attractive method of handling the subject.

You will find in the library catalogs which I collected last year and from which you can become familiar with the different machines used in woodworking establishments.

I thank you for your patient attention.

History and Philosophy of Fire Insurance Rating—First Paper

BY

EDWARD R. HARDY

The Making of Rates

First of four lectures delivered before the Insurance Institute of Hartford

FRIDAY, JANUARY 29, 1915

It has not been my privilege to listen to the addresses which have preceded this; no doubt, however, you are in close touch with what I call the larger factors in the business. By this I mean the premium receipts, the losses, expenses and amount at risk.

It is well, however, to set these before us in their larger aspect before turning to the concrete problems which we are to discuss.

The total wealth of the United States is estimated at one hundred and twenty (120) billions of dollars. Of this sum normally one-third is covered by a policy of fire insurance. This ratio seems to hold through a series of years. The premium receipts in round numbers have now reached approximately three hundred and twenty-five millions of dollars per year. Of this sum by and large 55% is paid out in losses. Another 40% is required for expenses, and a meager 5% is about all the Underwriter may hope to retain. To put the matter in a somewhat more concrete form, for each dollar received in premiums, $.55 must be paid back in losses; $.40 in expenses; and $.05 for reserves and dividends. I am speaking now only of the premium of course and not taking into consideration the returns from investments.

The average rate of insurance charged throughout the United States for a period of years is as follows:

In 1913 — $1.0417	In 1908 — $1.1444
In 1912 — $1.0596	In 1907 — $1.1697
In 1911 — $1.0594	In 1906 — $1.1469
In 1910 — $1.0822	In 1905 — $1.1679
In 1909 — $1.1224	In 1904 — $1.1613

The making of the fire insurance rate would be a comparatively simple matter if it was merely necessary to ascertain the total sum required to be raised and then to divide that

equally among the insured property, charging the same rate for each $100 of insurance. If it were possible to determine the rate of insurance in this simple manner, as the Assessor of Taxes does, the amount per thousand, the problem would be extremely simple.

DEFINITIONS: A few definitions may possibly be of some value in helping us to elucidate the problem. Broadly speaking, rates are divided into two classes — General Minimum Rates and Specific Rates. The Specific Rate is a rate applying to a given risk at a given location. It only applies to this one risk, hence its appellation, specific.

The General Minimum Rate is a rate applying to a class of business, of which the numbers are so large, the degree of hazard so uniform and light as to make it unnecessary to provide a Specific Rate. An illustration of this is found in the rates applying to houses occupied for dwelling purposes which are rarely, if ever, rated specifically, but a broad General Minimum is adopted applying throughout the given territory to the entire class. If I may use the City of New York as an illustration, it has approximately 350,000 buildings, possibly more exact statistics are not available. About one risk in seven or one building in seven is subject to a Specific rate. The remaining 300,000 buildings have applying General Minimum rates, these rates being furnished to the members and when application for insurance is made they make their own inspection and determine the rate applicable under the General Minimum.

The phrase "Flat Rate" is also sometimes used and refers to a rate which is subject to no reduction for any feature whatever, though in some states it may have a local application or meaning, as in the state of New Jersey, where it applies to the rates which are in force when the policies are written without co-insurance. Finally the phrase "Short Rates" is occasionally used and this merely refers to risks, which being written for a period of less than one (1) year, take a percentage of the rate as determined by the Short Rate Table and hence are called Short Rates.

In the year 1609 a proposition was made by a Count Von Oldenburg that a fund be created for the reimbursement of individuals who should meet with a loss by fire. It was suggested that for each $100 of valuation of the property, there should be a contribution of $1.00, which would make a rate of 1%. Nothing came of this early scheme and its only value to us is as throwing light on the first feelings toward establishing the rate of insurance.

Modern Fire Insurance, as you have probably learned, began after the great London fire of 1666. Probably in the year 1667, Nicholas Barbon founded the first fire office or set up, as the expression then was, the first office for the insurance of property from fire.

As to the method by which Barbon computed his rates, we have no direct information. None of his printed matter of the early days has come down. None of the proposals, nothing in fact to show from what data he determined the rate. We can only infer from the methods followed by his predecessors or tables published some years later, the practice adopted.

Barbon had first conducted his office as an individual but later formed it into a partnership. The earliest table, however, that we have is dated in 1681, which shows the following facts. The insurance was always for a term of years and this first table provided for policies for seven (7) years, eleven (11) years, twenty-one (21) years, and thirty-one (31) years. In all probability these periods conform pretty close with the leashold periods then in force in Great Britain.

The first rates were determined on the rental value of the property and their first table shows the rate charged from one to ten pounds of rental value and from that point an increase of 10 pounds up to 100 pounds. Thus if the rental value of a building was one (1) pound, the premium was 2 shillings, 6 dimes for seven (7) years. The practice, still followed, of making a concession where the policy was written for a longer term than the shortest period, was early adopted. Thus where the rental value was one (1) pound and insured for seven (7) years, the charge was 2 shillings, six (6) dimes. If the property was insured for twenty-one (21) years or three times this long, the rate was not three times that for seven years, but was twice that or 5 shillings. This practice is still in force and whenever the rate of Fire Insurance is quoted, it is necessary to bear in mind the practice governing the class of business to which the rate applies and the customs under which it is written. In nearly all parts of the world and especially in the United States, buildings, if written for more than one year, take a portion of the yearly rate for the term beyond one year. These terms vary in the United States, but a building policy may be generally written for three years for 2½ annual premiums and proportionate reduction if written for five or seven years. This applies also to certain classes of property as household furniture, but does not generally apply to stocks of merchandise or the goods in a manufacturing plant. In quoting the rate of insurance it is well to bear this fact in mind, that the annual rate may not be indicative of the amount which the insured is paying, since the class of property to which it applies might through practice and custom be written for a term of years, and subject to a fairly large percentage of reduction.

There never was a time in the history of the Fire Insurance business that the same amount was charged for each $100 of insurance regardless of the property covered. The classifying of the risks and the charging of the rate in accordance with the losses in the class was established apparently in the very begin-

ning. Thus the rates quoted above were taken from the table of 1681 and were for brick or stone buildings. For a building, say of timber, which word in Great Britain corresponds to our word "wooden," then the rate of the building was double the rates which I have quoted to you. This classification began with the business.

In the year 1690, which was twenty-three (23) years after Barbon had established his office, there apparently were within the bills of mortality one hundred and five thousand houses, of which seventy-three hundred are stated to have been insured. During this year, or by this time, at least, the method of determining the rate of insurance was changed, apparently passing from the method of basing the rate of insurance on the rental value of a property to basing the rate of insurance on the valuation of the property and, in 1700, the fire office which was the direct successor to Barbon's individual enterprise published a table giving the rates for one year, two years, three years, four years, and seven years; thus showing a much shorter period of time for which insurance could be purchased and showing the rate of insurance from ten (10) pounds up to 100 pounds, increasing by tens and from that with increase of 100 pounds up to 1,000 pounds. The same method of pro-rating was then in force if the insurance was carried beyond three years. Thus insurance for four years was at the rate of 3¼ times for a one year policy, and for seven years it was five times the annual rate. The rates are still quoted for brick or stone, double the amount being charged for timber.

A year or two later, the first mutual office appears to have been established and based its tables of the rate of insurance on the fire office to which we have just referred. It shows rates for the same period of time, but introduces the well-known feature of making a less charge as a fixed charge, but required a deposit. Thus if the house was valued at 100 pounds, the fire office charged 6 shillings for one year policy, the mutual office charged one (1) shilling four (4) pence, but required a deposit of five (5) shillings. Of course, the hope held out to the insured in the mutuals was that the annual payment would be sufficient to maintain the insurance, the deposit being secured and thus the eventual payments would be less under the mutual plan. Up to this time and indeed until 1708, houses only were insured. It is true that in the year 1696, the famous Hand-in-Hand Insurance Society, which was recently absorbed by another office was founded for the purpose of insuring both houses and goods, but it did not as a matter of fact undertake the insurance of goods until the year 1805. In 1707 or 1708, the exact date cannot be exactly determined, one Sir Charles Povey, a man something of the character of Barbon, established a fire office, making a specialty of insurance of goods. This office is now the well-known Sun Insurance Office, enjoying the reputation of

being thé oldest office engaged in the insurance business in the world. The records are not clear, but the attempts at least to insure goods may have been tried before this, but it is due to Povey to state that he first placed the business on the substantial basis, making it as commercially possible as Barbon did the insurance of houses.

The record would appear to show that no distinction was made in the rate of insurance between the insurance of goods and the insurance of buildings in which the goods were contained, the same tables apparently being followed giving the usual rates for brick or stone buildings, the table for timber and the goods therein.

In 1720-1, the proposals of the Royal Exchange Assurance, the oldest insurance corporation still in existence, stated that it would insure any college, hall, house or any other building, and all goods, wares and merchandise except notes, bills, tallies, books of accounts, ready money, china and glasswares, jewels, plates, pictures, writings, corn, hay and straw not in trade, to their full value, the assured paying but five (5) shillings per annum for every 250 pounds on brick or stone buildings or goods and merchandise therein and eight (8) shillings on timber, plaster or thatched buildings, or goods or merchandise therein. If the sum insured exceeds not 1,500 pounds of if the sum insured exceeded that sum the rates were 7 shillings and 6 dimes for each 150 pounds of value in the brick or stone buildings and 12 shillings in the other buildings. The classification apparently at this time as shown by their proposals began to be extended and probably the earliest reference to the segregation of certain trades appears at this period, since they refer to brewers, distillers, chemists, apothecaries, powder men, ship and tallow chandlers, sugar and bread bakers, dyers, soap boilers, oil men and color men as being more hazardous than others. Such persons must be under the five shilling rate or the 7 shilling, 6 dime rate for each 250 pounds of insurance in a brick or stone building and 12 shillings if in the second class of buildings. Likewise looking and other glass and china wares in trade being more hazardous, must pay the same rates. You will also note from this quotation which has been made in a liberal manner that the rate of insurance increased if the insurance passed beyond a certain sum. This principle of charging more beyond a certain amount of insurance continued in force in Great Britain until about 1805, when it passed away. It never apparently was in practice, or only to a limited extent in the United States and is probably not observed anywhere now in the world. At this point, however, it is also well to note that insurance up to the full value of the property was permissible, up to this time apparently no more than three-fourths of the valuation could be insured. The Union Fire Office, which only recently passed out of existence, founded in 1714-15, had a system of classification

which prevailed more or less for 150 years, they dividing risks into common insurances, half hazardous insurances, hazardous, and half hazardous, and doubly hazardous. They are said to have been the first company to introduce the classifications under the hazardous and doubly hazardous. Those under half hazardous or other fractional parts referred to the relation of a risk not hazardous to one which was hazardous and when a risk was offered for insurance, taking the surveyor's report the Directors determined in which class it should fall. The Royal Exchange Assurance Co. was the first company that stated that when a loss occured the assured would be paid in full. Previous to this time it had been customary to deduct 3% or 5% from the loss as payment for the expenses of settling the loss. The classification which was finally adopted and existed in Great Britain for a great many years was that of common insurances, hazardous and double hazardous insurances. This classification remained in vogue and is undoubtedly used today to a certain extent, with the exception that in Great Britain there is now in force some seventeen (17) specific tariffs applying to various manufacturies and warehouses. The first of these was adopted on June 1, 1843, and applied to woolen mills.

From time to time thereafter, up to the year 1906, these tariffs have been put in force for a single business. They generally apply to the whole of Great Britain, but occasionally are limited to Scotland or England and Wales. The most recent was the tariff applying to bleach, dye and print works, which was adopted June 7, 1906.

Previous to the year 1843 there apparently was not in Great Britain but very little co-operative action on the part of the fire insurance business concerning the rate making function. Since that year, however, when the first tariff on woolen mills was published, the business has been quite closely regulated by the Fire Offices Committee, although no tariffs are issued except for the larger manufacturing businesses. There are, of course, and always have been in Great Britain, certain companies which have never been members of the Fire Offices Committee and are known as non-tariff offices, but these apparently have not contributed any new plans to the business, but have depended rather on shaving the rates and the tariffs to some extent in order to secure their business. There are, however, very few companies in Great Britain comparatively speaking and the business may be said to be practically under the control, since the year 1843, of the Fire Offices Committee.

Coming now to the United States, there were attempts previous to the year 1752 to establish the business of Fire Insurance. The recent records have disclosed a company that was formed at Charleston, S. C., but beyond the fact of its having been organized and ready for business, no other data has been brought to light concerning its operations. There are evidences

that individual underwriters undertook the business of Fire Insurance. Indeed, Joseph Marion, an early insurance man of Boston, Mass., claims to have set up the first fire insurance office in the year 1724.

Since dictating the above, I have turned up exact data and facts concerning the first company and find that it was organized in Charleston, S. C., December 13th, 1735, i. e., the initial meeting was held on that date. On January 3rd, 1736 it was advertised that the rules were engrossed and ready for signature and the statement made out that the value of property proposed to be insured by those who had already subscribed amounted to 100 thousand pounds, the society to be organized on the 3rd of February, 1736, under the name of the "Friendly Society." I have given this reference in full because I think the facts are not generally known and you may find them of value. However interesting this may be concerning this company, the starting point for continuous fire insurance history dates from the year 1752 when the Philadelphia Contributionship for the insurance of houses against losses by fire was organized. The organization was completed on April 13th, 1752, on which date the directors were elected and officers appointed. This first company only insured houses or buildings and the insurance of goods was a much later development following in this respect the experience in England. All the evidence goes to show that the Philadelphia Contributionship practically drew its plan from the "Hand-in-Hand" in London. The rates in this first company were a modification of the London company. The London company required a fixed annual premium with a further sum known as the deposit. Experience showed that the deposit, the interest thereon at least was sufficient to maintain the company and pay its losses, hence the Philadelphia Contributionship merely required one deposit expecting to earn from the interest receipts a sufficient sum of money to pay the losses. The minimum period was seven (7) years and deposits for a brick building were 20 shillings for 100 pounds, and 60 shillings for a wooden building. There was one payment in addition to this of what was known as the common fund at the time the policy was taken out and this was 1 shilling, 2 dimes for brick and 2 shillings, 6 dimes for frame.

The buildings appear to have been divided into six (6) classes, a classification which practically followed the London company.

The third insurance company in the United States was, like the second founded in Philadelphia and became popularly known as the Green Tree Company, its origin being due to the fact that the Contributionship prohibited the insurance of houses with shade trees in front of them. This prohibition was due to the fact that a fire having occurred at the residence of one of their insurers, the firemen were hindered in their work of putting out

the fire by the shade trees. Certain members threatened to secede unless the rule was modified, which required the removal of the shade trees within three (3) months or insurance would cease and an attempt was made to compromise the matter. The company, however, remained firm and in 1784 the Green Tree Company was organized and required an extra premium where shade trees were in front of the house, this being one of the early instances of a definite recommendation for a higher charge for the increase of hazard.

In 1787, the Mutual Insurance Company was organized in New York and in 1794 the Insurance Company of North America, still in existence, was the first company regularly incorporated with a fixed capital for doing business on the American Continent. In none of these companies have we succeeded in discovering in any way of our researches, the exact statistics on which they based their rates. It is evident, of course, that while drawing heavily upon London, the experience of this country must have been entirely different from that part. There has come down, however, a pamphlet dealing with the organization of the Mutual Fire Insurance Company of Boston, which contains an exceedingly full statement of the resources from which they drew their data in determining their rate of insurance. The printed articles bear the date of the pamphlet in which they were published of February 21st, 1797. The salient paragraphs are as follows:

REPORT OF A COMMITTEE CHOSEN TO DIGEST A PLAN, AND FORM RULES AND REGULATIONS FOR A MUTUAL FIRE INSURANCE COMPANY.

FUNDS OF THE MUTUAL FIRE INSURANCE COMPANY.

Mansion houses supposed to be in Boston, ...	2,500
Stores and other buildings, ...	2,000
	4,500

Admitting that 1,500 buildings should be insured in this Company valued at Dol. 2,000 each 4-5th only insurable; we then say 1,500 buildings valued in policies at Dol. 1,600 each will amount to, ... Dol. 2,400,000

Dol. 2,400,000 being then at hazard, adequate funds are to be sought.

To effect this divide the buildings into six classes, with the rates of hazard affixed to each as follows:

Class 1 upon each Dol. 100 — 35 cents.
Class 2 upon each Dol. 100 — 37½ cents.
Class 3 upon each Dol. 100 — 40 cents.
Class 4 upon each Dol. 100 — 42½ cents.
Class 5 upon each Dol. 100 — 45 cents.
Class 6 upon each Dol. 100 — 50 cents.

Funds.

Funds raised by premiums and deposits, policies, transfers, endorsements, forfeits and interest accruing thereon, are denominated the Absolute Funds.

Funds arising from assessments, which the Directors are authorized to make in case losses should happen to consume the Absolute Funds, are raised by premiums and deposits only — Policies, transfers, etc., are not taken into consideration.

They may pay expenses of office.

Take a building of

1 Class, Dol. 1,600, 35 cents upon Dol. 100		5.60	
Deposit four times amount, . . .		22.40	28.00
2 Class, Dol. 1,600, 37½ cents upon Dol. 100		6.00	
Deposit four times amount, ...		24.00	30.00
3 Class, Dol. 1,600, 40 cents upon Dol. 100		6.40	
Deposit four times amount, . . .		25,60	32.00
		Dol.	90.00
Amount of 3 classes, ...		90.00	
4 Class, Dol. 1,600, 42½ cents upon Dol. 100, ...	6.80		
Deposit four times amount,	27,20	34.00	
5 Class, Dol. 1,600, 45 cents upon Dol. 100, ...	7.20		
Deposit four times amount,	28.80	36.00	
6 Class, Dol. 1,600, 50 cents upon Dol. 100, ...	8.00		
Deposit four times amount,	32.00	40.00	
	Dol.	200.00	
1494 Buildings will produce, ...		49,800.00	
			50,000

Second Conditional Funds.

1 Class, Dol. 1,600 at 3.58 cents, 7½ upon Dol. 100 produce, ...	57.40	
2 Class, Dol. 1,600, 3.81 cents, 2½ upon Dol. 100 produce, ...	61,00	
3 Class Dol. 1,600, 4.03 cents, 7½ upon Dol. 100 produce, ...	64.60	
4 Class Dol. 1,600, 4.26 cents, 2½ upon Dol. 100 produce, ...	68.20	
5 Class, Dol. 1,600, 4.48 cents, 7½ upon Dol. 100 produce, ...	71.80	
6 Class, Dol. 1,600, 4.93 cents, 7½ upon Dol. 100 produce, ...	79.00	
Added will produce, ...	402.00	
6 Buildings produce, ...	402.00	
1494 Buildings produce, ...	100,098.00	
		100,500
		Dol. 150,500

The funds here produced will support the loss of $94\frac{1}{16}$ Houses in 7 years, annually $13\frac{7}{16}$.

Suppose our absolute Funds in 7 years should accumulate 50 per cent. making $25,000.

We could then support the loss of $109\frac{11}{16}$ Houses.

Taking the intermediate time we could then support 101 14/16; nearly 15 annually.

We insure nearly, at first setting out, 16 times our capital, and here our boundaries are fixed. For should our amount at hazard increase, in the same ratio will our funds increase.

To know whether these funds are sufficient, let us take the best data possible.

In England the loss of buildings, by accidental fire only, is estimated to be annually 1 house in a thousand. Their buildings are of stone, or brick, and their fuel sea-coal.

In Virginia, in 1794, in their Incorporation, they have established eight rates. Their fourth is estimated at D. 250. upon 100 D. and members subjected to pay all losses by an assessment, in case the funds should be insufficient; the property insured is pledged. Their funds are increasing.

In New York and Norwich, in their Incorporation, they have seven rates. Their fourth is 30 cents upon 100 D.; and they deposit four times the amount, subjected to pay in case of loss, beyond the funds, 50 cents upon 100 D. for each fire. Their funds are increasing.

In answer to this, it may be said that the places above mentioned are not so much exposed, therefore we cannot take an accurate statement of a probable loss, in this town. This being

granted, we have recourse to the records of the Historical Society and recollection, which show from the following statement that our calculations are sufficiently accurate to answer our purpose.

In Boston for the term of 38 years, there have been 361 Houses and 335 Stores consumed by fire. And, the whole number of buildings, at that time, standing, upon an average, in this town, have been about 3,000.

Then we say, the loss sustained in 38 years, upon 3,000 buildings, has been 18 12/38 per annum, and upon 1,500, 9 6/38.

Upon principles here laid down, it appears that the funds are adequate, each member knowing at all times the amount at hazard, the state of the funds; and having a share in creating offices to superintend those funds, the plan is safe.

Other Insurance Companies wear a different aspect. They insure to an amount unknown to the insured — and they (the insured) at fixed periods, divide the profits.

This gives us not the power of arresting Eagles X in their flight. It simply gives the chance of domesticating those we have.

This is the earliest example that I have discovered of anything approaching research work in order to determine the rate of insurance on property.

From this time on the business of fire insurance or the organization of companies for the conduct thereof increased very rapidly. At what point in time there began to be concerted efforts in the making of rates is not absolutely known. The earliest records that we have show that in 1819 there was organized in New York City the Salamander Society.

Early Organizations in This Country.

1819-26. Salamander Society.

No regular officers; President and Secretary elected for each meeting. The Presidents and Secretaries of the different companies met on the first Friday of May, August, November and February (quarterly) until Sept. 28th, 1823, when standing officers were elected.

Embraced at first eight companies: —

Globe	Fulton
Eagle	Washington
Mutual	Merchants
Franklin	Mechanics

When it quit in January, 1826, it embraced twenty-six companies, the following being in addition to those already named, viz.:

Ætna	Manhattan
Contributionship	North River
Chatham	Orange
Equitable	Phœnix
Firemen's	Protection
Farmers	Sun
Greenwich	Traders
Howard	Trademen's
Jefferson	United States.
Lafayette	

Classes of hazards were adopted by this Society and it is interesting to note that the same nomenclature was maintained until a few years ago and as a fact exists today in the classes of hazards of the New York Board, viz.:

"Not Hazardous" like coffee, flour, household furniture, linen, paints ground in oil. Rate was .05 added to the rate of the building.

"Hazardous", like chinaware, plate glass, cotton in bales, fire-crackers. Rate was .10 added to the rate of the building.

"Extra Hazardous" like apothecaries, fur dressers, printers, rag stores. Rate .25 added to the rate of the building.

"Specially Hazardous" like bakers, gas makers or sellers. Rate extra as per table of Minimum Rates.

First agreement signed by insurance companies composing this Society February 2nd, 1821.

Uniform policy adopted June 19th, 1821.

Note the articles excepted under this policy as compared with Standard Policy of today (See pages 359 and 360, Vol. 3 of "The Insurance Times" 1870).

A form of rent policy was adopted by the Society in 1821. When the Salamander Society quit in 1826 it was succeeded by a new organization the name of which I do not know (See Hayden) and this or a successor must have remained in existence for some time because we have in our office a "Tariff for New York City" dated 1839. The New York Board was chartered 1863 with a provision in its By-Laws that it may maintain a rating bureau or tariff association.

1872.

New York Tariff Association was organized by twenty-seven companies and managed by committees of members.

The earliest attempt to deal with the rating problem in a general way was at a meeting held in New York City by the Companies so doing an agency business. The meeting was held May 12, 1896. The report of the meeting throws quite a good deal of light on conditions 70 years ago. The report follows:

A MEETING SIXTY YEARS AGO.

Of Fire Insurance Companies to Regulate Rates and Commissions.

The Journal of Commerce and *Commercial Bulletin*, October 18, 1908, has been favored with an interesting relic. It is the minutes of a meeting of the fire insurance companies held sixty years ago to regulate rates and commissions, and is presented in full as follows:

A meeting of the representatives of fire insurance companies of New York, Boston, Providence, Hartford, Albany, Oswego, Philadelphia, and New Jersey was held in the City of New York, May 12th, 1846.

The meeting was called for the purpose of taking into consideration the present state of business of fire insurance and to adopt such measures for its future managements as will do justice to the stock-holders and to that portion of the community who avail themselves of this mode of obtaining security of loss by fire.

The following resolutions were unanimously adopted:

Resolved, that the stock-holders of fire insurance companies are entitled to receive from those whom they insure such rates of premium as will meet the losses and yield a reasonable compensation for the hazard to which the capital is exposed and that it is believed the insured are willing to uphold the companies regarding such rates of premium as the best means of promoting their own security.

Resolved, That the great amount of losses sustained by the fire insurance companies of the United States during the last twelve years have rendered an advance of premium in all places where they have not been sufficiently advanced essentially necessary to a continuance of business and that it is the duty of those to whom the business of the companies is entrusted to adopt suitable measures to obtain such advance of premiums.

Resolved, That a committee of five be appointed to take into consideration the present condition of the business of fire insurance to ascertain from past experience the rates of premium required to meet the losses and yield a reasonable compensation to the stock-holders for the hazard of capital.

Resolved, That a committee of five be appointed to devise and recommend suitable measures for the better regulation of the business of fire insurance.

At an adjourned meeting held May 13, the two committees made a joint report upon the subjects referred to them with the following statement:

It has been ascertained from the statistics of fire insurance in the United States for the last twelve years that the business has not produced a profit equal to 3% per annum upon the capital pledged for the payment of losses; that losses by fire are yearly becoming more frequent and more extensive on all classes of hazards; that many of the companies have been entirely ruined; that the rates of premium in some places remain as formerly and in other places have been much reduced; that the increase of losses has not been confined to a few places, but has been widely extended.

It is believed that the whole amount of losses that have happened in villages and upon manufactories and other isolated risks within the last few years has been as great in proportion to the sum insured as in cities.

Although large dividends embracing the interest on capitals have in some years been declared by a few of the companies if the small amount of capital upon which they are made be compared with the whole amount embarked in the business and with the proportion of the aggregate capital upon the small dividends or none have been declared and the amount of capital entirely lost, it will be found to sustain the foregoing statement.

These results call for an advance of the rate of premium, that capitalists may not be deterred by the continual disasters from establishing and sustaining fire insurance companies and that the owners of the property may be guaranteed an indemnity against loss by an adequate accumulation of premiums as well as by the capital of the insurance companies.

The following rules and regulations with the classifications of hazards and rates of premium annexed, were approved and recommended to the companies represented for adoption as the best possible means of meeting the present emergency and providing for future losses:

Rules and Regulations.

1. The rate of premium charged by the local companies in any place where agencies are established are to be the lowest rates charged by the agents.

2. The agents are to be instructed to confer with the companies and other agents in the same place and the charge in all other cases not less than the rates of premium charged by them, to agree with such companies and agents upon the rates for special hazards and hazards not herein enumerated, and in places where rates of premium have not been established to meet with representatives of the local companies, or by themselves in places where there are none, on or before the fifteenth of each month to agree upon the rates to be charged for their respective risks, which are to terminate during the succeeding

month, to furnish each other with duplicate lists of their several risks, with the rates of premiums heretofore charged and the new rates agreed upon.

3. In the case of any deviation from the established rules and regulations or rates of premium the company or agent injured by such deviation shall ascertain from the company or agent that has deviated whether it happened by mistake or whether it was intentional; if the latter, the agent shall communicate the fact to the company he represents and to the companies and other agents in the place.

In the cities where rates of premium have been established such other mode may be adopted for the purpose of securing uniformity of rates as shall be deemed best by the local companies and agents at such places.

4. A less premium than the rate established, or a division of the commissions with the insured or any other pecuniary inducements shall be in no case offered or allowed for the purpose of obtaining a risk.

5. The compensation to agents shall not exceed 10% on their premiums received.

Classes of Hazards and Rates of Premiums in the Eastern, Northern and Middle States.

1. A building occupied entirely as a dwelling constructed of stone or birck with chimneys standing upon the same foundation, roof slate or metal, gutters metal, stove and pipes, if any, safely placed and well secured, 100 feet or more distance from other buildings, premium .30.

If the roof be wood with metal gutters, premium .40.

If the roof be wood without metal gutters, .10 to be added to the above.

2. Buildings of wood with a stone or brick basement, occupied entirely as a dwelling, chimneys, stoves and pipes as in first class, with a good lightning rod, .50.

If without a lightning rod, .60.

A wood house, wash house, privy or carriage house within 100 feet, if not connected, or endangered by a barn or other buildings in which fire or lights are kept, are not to increase these rates.

Upon the above described buildings when endangered by other buildings or premises, an additional premium to be charged equal to such additional hazard.

If a chimney or hearth stands upon beams, .25 to be added to the above premiums.

If occupied as a dwelling and store or as a store only, in which is contained a hazardous and extra hazardous merchandise and such articles as are usually kept in country stores, .25 in addition is to be charged for the building, the same additional or more to the rate of the building upon the merchandise.

Examples.

The building first mentioned occupied entirely as a dwelling, .30.

If occupied as a dwelling and store, .55.

If occupied as a store only, .55.

The building last mentioned, occupied entirely as a dwelling, .60.

If occupied as a store and dwelling, .85.

If occupied as a store only, .85.

The merchandise therein to be charged the same or a higher premium.

Taverns and hotels in the country distant 100 feet or more from the barn and stable and no other exposure, $1.00 to $1.50; a proper addition to these premises for any other exposure.

Taverns, barns and contents, $1.50 to $2.00.

In cities and villages the above mentioned buildings with no greater exposure to other risks, may be insured at the same premium.

3. Buildings in cities and villages where rates are not established by the local companies:

A frame building occupied entirely as a dwelling, adjoining or within 100 feet of another like building, .85.

If adjoining or within 10 feet of two like buildings, $1.00.

If in a row of three and not more than six like buildings, $1.25.

If occupied as stores, or some of them so occupied, .25 to be added to the above rates.

If one of them is occupied, or endangered by another building occupied for specially hazardous purposes, an additional premium shall be charged that will cover such hazards.

Brick buildings, situate as above mentioned, with a shingle roof, end walls (without windows) extending above the roof, a deduction of .10 to be made from the above premium.

Brick buildings situate as above, with slate or metal roof, end walls (without windows) carried above the roof, .20 less than the above premium.

The privilege of keeping more than 25 pounds of gunpowder at a time and that in tin or other metal canisters, shall not be granted without additional premium not less than .25.

Wherever stores are lighted by camphens or any preparation of turpentine or alcohol an additional premium of .10 shall be charged for that hazard, both on building and goods.

Western States.

The rates of premium in these states are to be regulated by the second and third rule, unless otherwise provided for hereafter.

Southern States.

The rates of premium in these states are to be regulated by the second and third rule, unless otherwise provided for hereafter.

Manufactories, flour mills and other special hazards: The rates of premium on these risks are to be regulated by the second and third rules.

Sixty (60) years ago the rate making in the United States was practically at the point where it had been for a large number of years. It was based on the classes of hazardous, non-hazardous extra hazardous and specially hazardous, this classification continuing in force up to a period within about ten (10) years. It is still found in a large number of the forms and is not infrequently used in the drawing of leases, where the tenant is expected to pay for any increase of insurance. In the agency field the rates were thus furnished by the companies as a part of their manual of instruction, a copy of which I have, being published in the year 1859 by the Hartford Fire Insurance Company. It contained complete instructions to the agents as to policy forms, method of surveying, determination of the rating and all other matters which the company deemed necessary to the successful conduct of business. It especially cautioned the agent that he should co-operate with the other companies, especially the local companies doing business in his territory in regard to determining the rate of insurance, but not to follow them to the point where the rate of insurance would, in his judgment as a representative of the company, be less than the hazard involved.

Forty (40) years ago, or sometime over that in the year 1866, to be exact, the National Board of Fire Underwriters, was organized. This organization had been projected previous to the conflagration at Portland, Maine, which occurred July 4th, 1866. It might have come into being without the impetus of that conflagration but it certainly was accelerated by that event. In all probability the attempt of the National Board of Fire Underwriters from its organization in 1866 to 1872 represented the most ambitious attempt to control the rate making function that has been witnessed in this or any other country. The plan was ideal since it provided for the central control by the National Board. In addition thereto there were agents or organizations for each state with subsidiary organizations for the more congested localities as the larger cities within the state. The scheme was quite successful in the early beginning up to the years 1871 and 1872, i. e., the business had recovered from the severe losses, especially the Portland conflagration and as the rate making function was so delicate that it was impossible for a central organization to control it, there began to be mutterings and the gradual breaking down of the rates. This proceeded so far that in the year 1872, the National Board of Fire Underwriters abandoned absolutely any attempt to determine the

rate of insurance, starting upon its present career, which is that of working for the general welfare of the business without in any sense entrenching upon the rate making function. Possibly this point would be as good as any to discuss the subect of rate making by organized effort on behalf of the companies. In the first place we would point out that the rate of insurance is possibly the most difficult problem that the companies are called upon to solve. It is affected by other factors than the measure of the physical conditions and by common consent or common experience the delicate function of rate making appears to be done by organized effort.

In Great Britain the Fire Offices Committee for nearly sixty-five (65) years has been in existence and performs for that country the work which the various exchanges do for this country. In Norway all the Norwegian as well as the foreign companies are members of the Tariff Union which is the rate making organization for that country.

In Japan, where the Fire Insurance Business is in its infancy, a tariff or rate making organization was formed in 1897. In Sweden all the Swedish stock companies and nearly all the foreign ones belong to the Tariff Union as it is called. It must be understood that these organizations in the countries in question repsresented probably the greater precentage, possibly 90% of the Fire Insurance Business which is done in the world. To repeat, almost by common consent the business of Fire Insurance, wherever established appears to adopt the form of making its rates by means of a traiff organization.

In the United States the rate making function is practically done throughout the country by a united effort. In all of the larger cities, Boston, Philadelphia, Chicago, etc., there are organizations dealing with the local problem of rate making. There are also larger organizations for covering the larger fields such as the New England Exhange, The Southern Tariff Association and like organizations for the Western States. These represent conditions where the business is scattered and is not concentrated as it is in the larger cities. New York City, for instance, has one-tenth (1/10) of the Fire Insurance business of the United States. The statement of this fact is sufficient to emphasize its importance. Now why is there a necessity for a rate making organization and why cannot each company for itself determine its rates? As we stated in the beginning of our paper, if it were possible to make the rate of insurance as the tax rate is made, i. e., by dividing the amount to be raised by the whole property valuation, the problem would be simple, or again if the business were confined to residence buildings, it would be comparatively simple, in fact, no necessity would exist for rating organizations because in such buildings as residences the number is so large and the degree of hazard so uniform that any company has sufficient volume both of premium

receipts and number of risks to determine an equable rate. Concretely expressed there are in the United States about fifteen (15) million buildings, of which, in all probability, over fourteen (14) million are merely ordinary residence buildings. Statistics of New York City, of which I am possibly more familiar than with any other city, may furnish a concrete example. Of the 350,000 buildings in the city, 50,000 are subject to a specific rate, the remaining 300,000 being written at general minimum rates. Thus in this group of 50,000 specifically rated risks there are certain classes which are segregated and stand apart by themselves. They represent buildings which at the time of their erection are destined for a definite purpose and maintain it almost throughout their whole existence. There are, for instance, something like 1,700 churches, 300 hotels, 200 theaters, 100 breweries and over 4,000 stables. The problem of rating, if it were confined to these definite classes, would not be difficult. The great problem arises, however, after we have eliminated the dwelling and those specific classes and have left about 10% of the total number of buildings in the city or country at large which are occupied for general mercentile or manufacturing purposes. The problem of correctly rating the 225,000 manufacturing establishments in the United States is one which taxes and will tax the best thought engaged in the business for sometime to come. These buildings represent such variation in structure, their occupancies are so diverse and the constant changes so numerous that the problem calls for the united experience and skill of the companies. It embraces such wide variation as a small one story frame building at one end and the modern fireproof department store at the other.

The experience of any one company is probably not sufficient to determine in this group of buildings and risks what the rate of insurance ought to be. As a mere matter of fact the hazard involved is such that each company only takes a small portion of the risk and in many instances would be only too glad not to take any of it. To illustrate, the Adjustment Committee of New York City which settles the major part of the losses for that city, reports that for the past year the average number of companies which were on each loss which the Committee settled was ten (10). It will be seen from this simple illustration that in order to write the insurance on that risk and determine the rate when application was made for insurance each one of the ten (10) companies would have been obliged to make an inspection of the risk and determine the rate for itself. The rating organization is primarily an economic organization. It does for each of the companies what each company would have to do for itself without such an organization. It is only an extremely small risk that one company will carry all the insurance. I recall that when San Francisco was burning and the insurance market was naturally extremely tight, that a broker desired to secure

$45,000 of insurance for a customer. The conditions were such that no company would take more than $1,000 worth of insurance and the line was placed in forty-five (45) different companies. Now if each of the forty-five companies had been obliged to compute the rate of insurance for itself it would have meant forty-five times the cost that it did to have this done by the central organizations. I am mindful of the fact that in all probability the rating by fire insurance companies has been, and I am inclined to think, will be, the subject of very severe attacks by the different legislatures. As you propably well know, there are in a large number of the Western States laws which are generally known as Anti-compact Laws and forbid the making of rates by the fire insurance companies by a united effort. In some states, of which New Hampshire is one, I believe, the local companies are permitted to confer in regard to the rate making and this concession probably serves the purpose of enabling rates to be made by united efforts. It is sufficient to state at this time that the United States is practically rated in one form or another by means of co-operation. Even in those states where the Anti-compact Laws forbid the companies to do it directly, the work is done through independent rating bureaus, as they are termed, and these rates are published and sold to the companies. If not held to in all cases, they, at least, furnish the company for a slight charge the best judgment in regard to the rate on the property that they can secure without going to the larger expense of doing the work themselves. It is possible that this form of rate making, viz.: by independent bureaus will come in time to be established throughout the United States, but there are no indications at the present time that the feeling against rating organizations is any stronger than it has been in the past. In fact, if anything, it is probably more lenient.

The Dean Schedule, to which we will refer later on, has done much for the entire western country to change the attitude of the law makers and the establishment of fire marshal laws are helping the situation a great deal more. All of these efforts are telling in the right direction and the future is certainly full of interest whatever it may bring forth.

Turning now from the broad consideration of the problems let us consider for a brief while the actual method by which the rate of insurance is determined. We have pointed out that there were two methods or two forms of rates, viz.: the general minimum rate which is a fixed charge for a certain hazard under certain conditions and the specific rate, which is based almost always upon the schedule. The general minimum rate simply represents the best judgment of the organization or rating bureau in connection with the hazard. In New York City, for instance, a private dwelling occupied by not more than two families, of brick or stone has a rate of .10 for each $100 per year and may

be written for three (3) years at $2\frac{1}{2}$ times that rate. These are fixed rates and are only subject to one reduction and that is to 10% for full co-insurance.

Passing from such simple problems of rate making and turning to the rates which are made specifically for specific risks at specific locations we reach the subject of schedule rating. Of schedule rating, as we understand it today, there was but little conception fifty (50) years ago, but in the tariff issued in 1839 there was a list of deficiencies to be charged for when rating warehouses and stores that contains many of the points which we now take into account in our schedule. For instance, it provided that a building, if of brick with tile, slate, metal or cement roof, with brick, stone or metal gutters with solid iron shutters and without dormer windows or skylights, if situate upon a street not less than fifty (50) feet wide, might be insured at .30 and charges running from .01 to .15 are listed which were required to be added to this base rate for deficiencies in any of the particulars named, all of which, although published seventy (70) years ago is suggestive of the "Standard Building" and "Deficiency Charges" of present day methods.

An early rating schedule recognized as such and called by that name was developed at St. Louis in 1873 and 1874 and was formally adopted, printed and put into operation by the St. Louis Board in 1875. Its general scheme is credited to Mr. Western Bascom, but the working out of its details was done by Mr .C .T. Aubin at that time Secretary of the Board. It assumed a "Standard Building" and added to its rate deficiencies in such features as stairs, area, height in feet, walls, roof, cornice skylights, hatchways, well holes, elevator shafts, communications and exposures, and charges were provided for stocks based upon their damageableness, as well as their location below or above a certain story. This schedule provided for rating of classes of business, mercantile and manufacturing and has done its work so satisfactorily that it is practically in force in St. Louis today although a certain section has been rated on the Dean Schedule.

There are two schedules, however, which have done the greatest work of any schedule that was ever prepared. The first one, the Universal Mercantile Schedule was prepared by a committee under the chairmanship of the late Mr. F. C. Moore of the Continental Insurance Company. It was tested through two years and some six editions until in 1893 it was published in complete form and with modifications it is now largely in use in the eastern cities.

The seven (7) cardinal principles on which the Universal Mercantile Schedule is based are the following:

First — A schedule should recognize a key rate as a starting point, viz.: the rate of a building of standard construction in a standard environment: i. e., in a city presenting the most

favorable conditions for the prevention, discovery, extinction and confinement of fires to single buildings; and that the difference between the starting point, or base rate, of one city as compared with another should be explainable by charges for variation from standard. Unless differences between two cities as to the same character of structure are explainable, jealousies and antagonisms will result in developing adverse legislation.

Second — Inasmuch as all the risks of a city cannot have the maximum benefit of the fire department, especially where street water mains are of inadequate sizes, it is clear that all risks in the city should not be rated alike, even though indentical in construction and occupancy, but that they should differ according to the sizes of street mains, proximity to hydrants, fire engine houses, etc.

Third — Certain features of construction, like self-releasing floor beams, for instance, which improve a building, are of no benefit to the stock. The stock therefore should not receive credit for them in the rate. A system of rating by adding some fixed sum to the final building rate to get the stock rate must, by this process which recognizes features that are not of advantage to the stock, result in an adequate stock rate.

Fourth — Fire extinguishing appliances, especially for throwing water, should not receive credit in computing the rates of stocks to the same extent as in computing the rates of buildings, because water throwing damages stocks to a greater extent than buildings.

Fifth — Exposures should be treated differently in the case of buildings from stocks. A building may be so constructed as to be a complete protection to its stock, but require a charge in its own rate for possible damage to its exterior, paint, etc.

Sixth — The rate of a stock should approach that of the building containing it in proportion as the latter is of poor construction, liable to be totally destroyed, and in proportion as it is deficient in fire extinguishing appliances; whereas there should be a rate difference between the rate of a building and its stock if the building is of standard construction and its fire extinguishing appliances are of the best. And this difference in rate should never be determined as a matter of judgment, but by some automatic process which will adjust the difference in rate to the conditions. This the Universal Schedule does. No other schedule has provided for this vitally important feature.

Seventh — The fire record of a city should be taken into account in computing rates, both at the beginning and ending of the term for which the rate is computed. The Universal Schedule recognizes this.

If at the end of a given term the percentage of loss to premium is less than 55% a reduction of 1% is made for each 1% of reduction in percentage; so that if the percentage is reduced to 40, 15% reduction in rate would be allowed on renewals. Any

system of schedule rating which charged for improper construction (and would therefore encourage proper construction) and which charged for faults of management (and therefore would encourage cleanliness and other features which tend to prevent fires) would inevitably result in a reduction of the fire loss, and should be recognized in the rate by some systematic and equitable percentage of reduction. If not so recognized, it will result in rate cutting and demoralization.

It is not a serious question, in this view, whether the individual detail charges of a schedule are too high or low, since it will be adjusted in this way to a proper basis.

The Dean Schedule in a sense does not differ so radically from the Universal Schedule, but it enjoyed one advantage. The Universal Schedule had been before the public for some time and so the public mind was prepared for rating on a somewhat minute system of rating which both the Dean and Universal Schedules followed. On this I wish to emphasize the point that when schedules which so minutely analyze the risk as the Universal did, we noticed there was strong opposition to the amount of work involved and a good deal of this had passed away when the Dean Schedule some years later came upon the world. The schedule differs in its origin from the Universal. It is very largely the personal work of Mr. A. F. Dean, and was first intended for application in the small villages and towns in the western part of the country. By process of changing and adaptability it was developed to the larger towns and smaller cities and finally, as above, used in the largest cities of the West.

In regard to the starting point, corresponding to the key rate in the Universal Schedule, there is a base rate, which Mr. Dean considers as made up of those factors in a fire loss which cannot be reduced to a system. In all probability, this basis rate, although not recognized as such, is in reality based on the fire losses through a series of years.

It is after it has passed the base rate point, that Mr. Dean claims the greatest merits of the schedule exist. When he proceeds to charge for deficiencies, he makes these, not as in the Universal Schedule, a fixed sum, but he makes them a percentage of the base rate. Thus instead of charging .10 for the floor openings in a certain condition, Mr. Dean would charge 10% of the basis rate, and having analyzed all the features in a building which should be penalized the whole of these percentages are taken of the base rate and added to it. Thus the base rate might be 1% with 60% added for the deficiency charges, but the one thing which Mr. Dean has iterated and re-iterated is the fact that the fire loss is a system of relations and that these relations are always a certain part of the base rate. It would be readily seen that under this system of rating, the final rate will be affected by the base rate which is adopted. This is true under the Universal, but it will be affected more under the Dean

Schedule because the additions for deficiencies are always percentages of the basis rate and if we cut our basis rate in two, then we cut in two every charge in our list of deficiencies.

In addition to the deficiency charge there are percentage charges taken of the base rate for each occupancy, the whole finally being added to the base rate, then we have the rate of the building occupied. Additions are then made to the base rate for each tenant in order to secure the rate of the tenant itself, these additions being based on a fixed charge according to the class of protection, within which the risk falls.

The system of credit follows the Universal Schedule and has a system of percentage for various fire fighting devices, the exposure charge being much simpler in its operation than the Universal. The keynote of the Dean Schedule and the thing on which Mr. Dean insists is the law of relativity which runs through the entire work.

The Dean Schedule has given much satisfaction throughout the West and there are those who predict that it will eventually cover the entire country. The business has been much criticised because in different parts of the country, varying methods are used in producing rates. The Dean Schedule meets this objection in the West at least.

In bringing our subject to a conclusion, we should point out that the mere determination of the physical hazard may be, as it is, after all, only one of the things which the rating organizations must control if it is to control the business within its territory. It must control the form under which the risk is insured, since obviously for a given rate a certain privilege may be given and if after the rate were made it were possible to give any privilege desired in connection therewith, the rate might be altogether too low for the hazard assumed. Therefore in its effort to establish equality, the rate organizations are obliged to keep an exceedingly strict control of the general conduct of the business as well as the mere making of rates based on local conditions. A single illustration will suffice, viz: all policies within a given class must not only be issued at the same rate, but they must have the same clauses attached. If some are issued without the co-insurance or average clause this single feature alone would be a substantial reduction in the rate of insurance to those who secure such policies. This is true of all factors entering into the problem, and we must remember that the fire insurance contract is based not merely on the premium paid, but on other considerations and it is these other considerations which are of as much primary importance as the mere rate itself based on physical conditions.

Standard Policy—Clauses and Forms

First Paper

BY

WILLIAM B. MEDLICOTT

Fire Insurance Forms and Clauses

When the subject of these lectures was first suggested to the writer, it seemed to him that the person best qualified to deal with it would be either a broker of long experience or the counter man of some large city agency, for the opportunities presented to men occupying these positions are vastly greater than come to one whose principal connection with underwriting has been that of a Home Office official. On the other hand, realizing the pressure that is constantly brought to bear by the assured for liberal and at times, unjustifiable provisions in a policy form, the broker or the counter man must indeed be made of heroic material if he does not become deadened to a sense of the Insurance Company's rights and allow himself to become accustomed to viewing the contract wholly from the standpoint of the Assured. No business, especially one so far reaching in its operation as fire insurance, can long prevail or can work lasting good to the entire community, unless proper consideration is given to both contracting parties and, it is more likely that those forms which will best stand the test of time and use will be the ones that will commend themselves to the Underwriter whose desire for business causes him to be liberal to the assured and whose ambition to make his underwriting a success causes him to exercise a proper caution. In speaking to you then of forms and clauses, it will be my aim to emphasize those that are just and reasonable to both parties to the contract and to discourage the use of such as are wholly one-sided in their application, in brief, forms and clauses that guarantee the assured his rights and at the same time safeguard the insuring company against uncontemplated or unreasonable risk.

The general impression prevails that the Insurance Companies are the authors of the various attachments to their policies. The actual condition now, however, appears to be that the assured, the broker, or the various state legislatures all have a hand in their preparation. The Insurance Company, who in the event of loss must pay the bills, is virtually situated as would be the manufacturer, whose customers design his goods and fix his priees.

Why, you may say, do the Insurance Companies allow this? Some do not. Competition, that remover of many safeguards as well as disagreements, is mainly responsible and constantly causes greater latitude to be allowed by the Insurer than good judgment can at times approve.

The making of Fire Insurance forms and clauses and the selling of Insurance Policies is not unlike the making and selling of any other commodity. For the maker of or dealer in any article of sale to insist on a certain style, quality or price for such article regardless of what the public requires, inevitably means that sales will fall off if not cease altogether. Also if the purchaser says I will pay just so much and the article I purchase must be of such material and make, regardless of the cost of its production, he will soon find himself without the desired merchandise. The only basis on which permanency and profit can be attained for both parties to the contract is for the producer to furnish what meets the needs of the consumer at a reasonable price above cost. And for the consumer to get what serves his purpose at a price he can afford to pay.

Styles and Costs in Fire Insurance contracts when Standard Policies are used depend wholly on the forms and clauses attached thereto. To secure the use of those that will admit of a living price for the Insuring Company, and to furnish the assured the protection he can rightly expect, should be the aim of all responsible for their drafting, selling, and acceptance. In no other way can their use be made equitable or permanent.

It is difficult to imagine a more comprehensive title than that of Fire Insurance forms and clauses. They are without number and are constantly increasing. Only the general forms obtaining can be touched on in these Lectures and my aim will be not so much to try and tell you how to devise forms and clauses as to caution you as to what to avoid.

Many illustrations will of necessity be used in these talks, and many words of explanation or description spoken of which no record can be kept and memory is too treacherous a medium to rely on in revising manuscript for publication. Lectures like the following necessarily are delivered in form more or less directed by the questions asked by members of the audience, and from the mental suggestions that come to a speaker under the inspiration of an audience of men whose life work is with the things that are being talked about. This will explain in part the fact that these lectures as delivered and written may vary somewhat.

Relation of Forms and Clauses to the Standard Policy.

Those who attended the lectures of last year on the Standard Policy were told of its various provisions. In order to take up the subject of forms and clauses intelligently, it will be necessary for us to review briefly some of the features of the Standard Policy

in order to note those of its provisions which may legitimately be affected by added forms or clauses and those which should never be altered in the slightest degree in their purpose and intent. It may be well at this point to say that the only wise course is to do as little "tinkering" as possible with the Standard policy contract. Its provisions in the main are wise and equitable and protect the rights of both parties. On the other hand, there is no question but what under certain conditions and for purposes of more clearly defining the application of this Standard contract, it is wise to attach such clauses as shall provide for special conditions. For example, the addition of any clause that seeks to alter or set aside the method of procedure in the policy over the settlement of a loss would be most unwise, illegal and prejudicial; or the waiving by rider attached to the policy, of the conditions of cancellation or the contribution of other interested companies; or the time that may elapse between the adjustment of a loss and the payment thereof, should be absolutely avoided. On the other hand, if the insuring Company sees fit to grant the storage of hazardous materials; or to waive the voidance of the policy on account of the unoccupancy of the premises under certain conditions; or to allow the operation of a manufacturing establishment for longer than the usual work-day period, are privileges that they undoubtedly have the right to grant if they see fit. We shall later take up more in detail some of the provisions that can and those that cannot be wisely waived, but in the main it is a safe rule to follow, that the underwriter must not devise or accept clauses that directly contravene and set aside the safeguards for either party, that are embodied in the Standard policy form, nor should the assured demand them.

Authorities on Forms and Clauses.

In studying this broad subject of forms and clauses, one finds an almost unlimited field for research, and while it would be impossible to enumerate all of the sources of information, I want at this time to express a special obligation to the following authors and books:

- Richards on "Insurance Law."
- Moore's "Fire Insurance and How to Build."
- Deitch, "The Standard Policy."
- Hine's "Book of Forms."
- Crawford's "Pointers for Local Agents."
- Various Manuals of Rules and Forms promulgated by the different Underwriting Bodies here in the East.
- Collection of forms and clauses issued by certain Insurance Companies for the guidance of their Agent.

Difference Between Forms and Clauses.

Now what are Forms and what are Clauses? I do not know that I have ever seen a definition broad enough to clearly define the difference; but to me it seems in a general way as if forms were those attachments or riders placed on an insurance policy that are descriptive in their nature, while clauses are the attachments or riders that are either permissive or restrictive in their application. By this I mean that the term "form" may be properly applied to that attachment to the policy that describes who is insured, what he is insured against the loss of, and where it is located; while clauses may define what can be allowed that the policy itself may or may not prohibit, what provisions there may be over other interests than those of the party holding the title to the property or some agreement that shall fix conditions of liability in the event of loss occurring. These are only a few of the permissions or restrictions that clauses may bring into the policy contract but will serve for the present to illustrate the line of demarkation between forms and clauses.

So far as I know there has never been an attempt at a general classification of forms and clauses and such classification must to a large extent be arbitrary. In order that we may take up the study of forms and clauses in a consecutive manner, I have decided to sub-divide them as follows:

Classification of Forms and Clauses.

Forms.

1. Those of description, meaning thereby who is insured and against the loss of what he is insured and where he is insured.
2. Forms for other than fire liability, such as Use and Occupancy, Rent, Leasehold Interest, Profit Insurance, etc.
3. Forms of extended area that is those that cover the loss of certain defined properties in more than one location. Forms of this character refer especially to floaters and common carriers.

Clauses.

1. Clauses of permission, such as permits to store gasoline or to extend operations or to grant builders' permits, etc.
2. Clauses of exemption and warrant, such as spontaneous combustion clauses, consequential damage clauses, electrical permit clauses.
3. Clauses of title and insurable interest, such as the Mortgagee Clause, the Leased Land Clause and the Subrogation Clause.
4. Clauses for especial emergencies, such as the Earthquake Clause, the Excess Insurance Clause, Binders, Demolition and Disclaimer Clauses.

5. Clauses of liability limitation, such as the Average Clause, the Three-quarters Loss Clause, the Three-quarters Value Clause and the Co-insurance Clause.

We might also add, judging from the practice at the present time, another set of clauses, which might well be entitled "Clauses of Absurdity". Clauses of this nature are ones such as some of our Western States seem to take great pleasure in exploiting. Also certain ambitious brokers who can only view the insurance contract from one side, namely that of the assured, are very fertile in the invention of clauses of this character. Clauses in fact, which have the general effect of making the company liable for no matter who the assured is, what he may do and when or where he does it, and are broad enough to cover anyone, anything, anywhere, at any time. A simple illustration of this form is one that has recently been brought out, where a Sprinkler guarantee was attached to the policies with the provision that if the Sprinkler was not kept in good working order, the policy should not be voided thereby; a clause that contradicts itself. Doubtless clauses of equal absurdity have been exploited by certain of the insurance companies, but for real ingenuity in the invention of these one-sided, absurd and wholly inequitable clauses the unscrupulous and ambitious broker and the ignorant law maker are a long way in the lead.

Like everything else in this world, forms and clauses are good or bad and it should be our purposes in studying them and seeking to learn their real meaning and effect, to aim always to so devise and apply them as to work the greatest measure of good to both parties; to seek to avoid one-sidedness or the taking of a position that places all of the advantage in the hands of one of the contracting parties, a rule that should apply to every business contract of whatever nature.

The Viewpoint of the Loss.

In studying the working of any form or clause, *always take the viewpoint of the loss.* It matters but little what forms or clauses are attached to the policy if no loss occurs, but it means a great deal to one party or the other should such loss occur. Therefore, seek to place yourself in your study of forms and clauses, in the position that you would occupy had a loss occurred under the policy and you were seeking to accomplish an equitable liquidation of the resulting claim.

Provisions of the Standard Policy.

We must bear in mind that the Standard Policy is itself, made up of clauses or provisions and it is well at this point to call particular attention to these provisions, as they must always be considered in the devising of either forms or clauses that are to be

attached to the policy, since such supplementary forms or clauses either modify the effect of or completely set aside one or more of these so-called "Clauses" in the Standard Policy form. In considering this phase of the Standard Policy clauses we will confine ourselves to those of the Standard Policies of Massachusetts and New York State, the latter being the standard of Connecticut also, since in the main they embody all of the important features of any well drafted policy. You will note that the first phrase of importance in either one of these forms is the naming of the insurer, the consideration paid by the insured, for the protection offered by the insurer and the limitation, or that is, the maximum amount that can be recovered under such policy. Also in the Massachusetts form, after speaking of the premium consideration the words, "receipt whereof is hereby acknowledged" are inserted. Now it would be wholly inadmissible for any clause to be attached to a policy that in any way superceded or set aside these provisions, unless sanctioned by state legislation as has been the case in Massachusetts, where the requirement of tendering unearned premiums may be waived under certain conditions by the attachment of a special rider.

Who is Insured?

The next phrase of importance contains the words, "do or does insure." Remember that we insure people, not things, and the name of the party or parties seeking the protection of the policy should always be clearly defined at this point. Also the fact and nature of their insurable interest should be beyond question and should be plainly stated. No clause should be attached to a policy that sets aside these provisions other than a Payee or Mortagee Clause relating to some other interest in the property or the naming of some party who shall act as Attorney for the assured with regard to recovery under the policy in the event of loss.

What is Insured?

A description of the property for the loss of which the insured is to be indemnified naturally follows the naming of said insured, and at this point in the policy the insertion of a descriptive form or rider is necessary. This form ordinarily describes the nature and the location of the property, but in the event of the indemnity offered being for other than direct loss by fire, that is for insurance of the Use and Occupancy, Rent, Leasehold Interest, Profit, etc. type, it is necessary to define the nature of this insurance in connection with the description of the property covered. It is also usual to attach to this form of description, such further clauses of permission, restriction or limitation as may be mutually agreed upon.

Term of the Insurance.

The period for which the contract shall run, or the term of the insurance, is one of the policy provisions that it would be absurd to seek to amend or alter by means of any attached rider.

Voidance Provisions of the Policy.

Following the description of the property we find in the policy contract a number of provisions defining conditions under which the company shall not be liable, in other words, voidances, such as concealment, or misrepresentation or the storage of hazardous or inflammable compounds, or the conduct of any extra hazardous business. Also losses that might be occasioned by invasion, insurrection, riot, civil war, military or usurped power or theft or neglect of the assured to use reasonable means for saving or preserving property. Any of these have the effect of rendering the contract void and freeing the insuring company from liability. Clauses waiving any or all in fact of these features are clearly within the right of the company to attach to their policies if they so elect.

May Assume Liability for Damage by Lightning.

The assumption of liability for damage caused by lightning, not covered by the Standard policy contract is also a condition that the insurer clearly has the right to assume by the attachment of a proper clause, if he so elect.

Provision for Cancellation Cannot be Changed.

That portion of the policy providing the way in which it may be cancelled, it is clearly evident, neither insurer or insured has any right to change nor may either rightfully claim any other method of procedure than that defined in the Standard Policy contract, and a clause seeking to effect such change would be clearly out of place.

Other Insurable Interests.

Mortgagee interests may be recognized and therefore form a proper subject for the attachment of a clause to the standard policy contract.

Provisions Over Removal.

The removal of property endangered by fire to a place of safety as provided in the standard policy, is one that would not reasonably admit of the attachment of any clause to the policy waiving its provisions, and it is most unlikely that anyone would seek to devise such a clause.

Provisions for Arbitration Cannot be Changed.

The clause in the contract relating to the way in which losses shall be adjusted and paid is one that surely admits of no alteration or amendment by the addition of attached clauses.

In short, those features of the policy that define clearly its limitations and the methods of procedure thereunder, do not with any sense of equity, admit of alteration or amendment by the attachment of clauses, while permission to waive certain policy provisions that are designed to safeguard the insurer against unusual hazards, or the protection of interests other than those of the party holding title to the property are clearly provisions that admit of special treatment such as can only be accorded by the addition of proper clauses. Furthermore, clauses defining the relation between insurance carried, sound value and loss, are all of them perfectly proper and admissible, provided both parties agree thereto.

This in a broad way defines what may and what may not in the Standard policy form, be altered or modified by the use of attached forms or clauses, and in devising forms or clauses to meet special emergencies, those features of the policy which we have mentioned as being distinctly inadmissible of alteration, should always be borne in mind by one who is drafting a form or clause.

Desirability of Uniformity in Forms and Clauses.

It is well at this time to emphasize the importance that attaches to standard and uniform forms and clauses. Forms of description must of course vary with every different property or assured covered, but clauses of permission, of liability limitation, of the assumption of other than fire liability, or for special emergencies should adhere closely to some prescribed standard that meets not only the views of the underwriter, but also commend themselves to the insuring public as a whole.

Before we begin on a detailed study of the various kinds of forms and clauses, there are a few matters of general instruction both in policy writing and in the devising of forms and clauses that had best be first disposed of.

The Contract One of Personal Indemnity.

A Fire Insurance policy is essentially a contract of personal indemnity. It is true that some of our State Legislatures in their ignorance have seemingly lost sight of this fact, but it is a fact, and any other view is a perversion. Remembering this, that the policy is a contract of indemnity never devise or consent to the use of a form that makes it a contract of another sort, that is, avoid all forms and clauses that introduce the valued feature into a policy contract. Possibly, to some of you, it is not wholly

clear just what is meant by "valued." It means the so wording of the contract that in the event of a total loss, the value of the destroyed property is the amount of insurance thereon, wholly irrespective of what its actual value may be. Policies of this sort are a premium on fraud, a menace to the community, become ultimately a tax burden to policy holders as a whole and tend to lower the moral standard of the locality in which they prevail.

We ordinarily think of the valued policy as applicable only to buildings, since they are the class which the law has generally made applicable to a contract of this sort, still almost unknowingly at times, forms are allowed to slip through that contain this same pernicious valued feature. For example any form or clause that states that in the event of a loss, a certain fixed sum for certain specified articles is agreed upon to be their actual value, entirely sets aside the important indemnity feature of the contract and may work great injustice and ill, usually to the insurer, but sometimes to the insured. Again forms or clauses that aim to fix the insurable value of articles destroyed (regardless of who the insured may be) as being the market price for such articles at the time of loss, may work contrary to the principle of indemnity that should never be lost sight of, since in this obscure way profits are oftimes being insured as well as the direct fire loss or damage. Illustrations could be multiplied indefinitely of the way in which this valued feature creeps into the wording of forms and clauses, sometimes innocently though more often with intent on the part of the framer of the form, and it is always desirable to bear in mind in the devising of any clause, descriptive or otherwise, to see to it that this pernicious principle shall not even in the least degree prevail.

The Headings of this Policy.

Just a few general instructions as to what might be termed the "heading of a policy" and we will then proceed to the direct subject of forms and clauses. The policy writer at the outset has before him a printed form or contract, the Standard policy of the State in which the insured property is located, and his first attention should be to enter clearly the amount or limitation of the policy. Coupled with this is the consideration or premium for which the policy in question is issued, this bears, by virtue of the rate, a certain fixed relation to the amount. Then follow the words "does insure" or "do insure" and the name of the insured party, and the entering therein of this name calls for more careful consideration than often times is given it. Avoid initials, write the name or names as fully as possible. Avoid ambiguous phrases, such as "Heirs of So and So" or "So and So, et. al.," unless at the same time you designate some one party who is empowered to act for all. It is easy to foresee the embarrassment and trouble that may arise in the event of a loss under policies

where this broad, vague way of defining the insured parties may appear. In the case of "Heirs of" it is at times impossible to know who all of the heirs are and should a loss be settled without the concurrence of each one of them, and possibly be paid, there is nothing to hinder the ignored heir later on from turning up and justly claiming and probably securing, recognition of his or her rights with accompanying repayment of his share. The "et al" feature which sometimes appears where there are several owners can easily lead to the same confusion and possibly double payment, since "et al" is a very difficult party to locate with certainty.

Not only is it necessary to name the Assured in a clear and unmistakable manner but in the event of his interest in the property being other than that of sole and unconditional ownership, such fact must be clearly brought out. In cases where there are joint interests or where individuals are transacting business under a trade name, the nature of the Assured's interest, in the former case, and the individual names as well as trade name, in the latter instance, should be clearly entered upon the policy.

Standard Policy—Clauses and Forms

Second Paper

BY

WILLIAM B. MEDLICOTT

Forms of Property Description and Location

Who is Insured?

In our last lecture we spoke of "who" was insured and in a general way touched upon the various provisions of the Standard policy contract as a whole. Certain things that it was desirable to avoid in defining "who" the Assured is, have also been spoken of. Now, naturally follows "what" is it that we insure these parties against the loss of?

We must again impress upon your minds the question of viewpoint or attitude that it is always essential to take in devising a form that is to be attached to the policy contract. The viewpoint of the loss is the only safe one to take. Look at the form that you devise as you would had a loss occurred on the property which it is designed to cover. Any other point of view is valueless.

Another fact to remember in the drafting of any contract form is that such form, if the contract is to be a thoroughly satisfactory one, must represent the idea that is in the minds of both parties to the contract, that is, the contract should always consummate by the getting together, as we might say, of the minds of these two parties. A contract that means one thing to one of the contracting parties and another thing to the other is a trouble-breeder that is most prolific.

What is Insured?

In speaking of the forms that are attached to the policy contract, we termed them as being riders that are descriptive in their nature, and in the first class of such forms are those that describe the property for the loss or damage to which by fire, the Insured is to be indemnified. While forms determine also, the nature of the indemnity offered if other than that of direct fire loss, such for example as Use and Occupancy, it is our purpose at this point to confine our attention to those forms that describe the property itself, wholly irrespective of whether the covering is against direct loss by fire or loss of some other nature.

It is the form also that determines whether the insurance is to be of the specific or of the blanket or compound type, or whether the Policy is to be of the usual kind or an open one or a floater, that is, whether it limits the property covered to that of one kind, in one described location, or of several kinds in several described locations or for a fixed or a variable limit in amount covered, or anywhere within certain more or less widely defined limits.

Now, while you all probably know just what we mean by a specific and what by a compound, as well as by an open and by a floating policy, still, possibly some of you do not, and so we will try and define the same.

A SPECIFIC POLICY is one that covers property of one kind or class in one fixed location, or that applies to an aggregate sum apportioned in fixed amounts between various different properties, or in various defined locations. For example, a policy of $5,000 on one building alone is specific, or for $5,000, stating that $2,500 each is to apply on two described buildings is also specific.

Blanket or Compound Policies.

A Blanket or Compound policy is one offering a contrast to the Specific form, in that it covers properties of different classes or in different locations without apportionment or distribution, as, for example, a policy of $5,000 on a manufacturing plant in its entirety, including buildings, machinery and stock, but not defining how much is insured on each one of these items, or if the plant includes more than one building, how much is insured in or on each one of these buildings.

Open Policy.

An open policy may be either specific or blanket in its application. It is a policy that is sometimes called a "running" policy and it is used where the assured will be likely to require many successive insurances from the same company. It covers properties (usually merchandise) in such amounts and in such places (usually ware-houses) and at such rates of premium as shall from time to time be agreed upon and endorsed on the policy, or in a book attached to the same. The object of such a policy is to do away with the procuring of a new policy for every transaction. Policies of this form are most frequently used where stocks of merchandise are continually being placed in or withdrawn from a storage warehouse.

A Floating Policy.

A Floating policy is one that is very broad and general in its application, since it may cover certain specified properties anywhere within more or less widely defined limits. Such prop-

erties cannot be specifically described because of constantly changing quantities and locations, such as merchandise or other property in transit. The amount covered under such a form of policy can only be determined at the time of loss under the same. A popular definition of a Floater policy is that it is one that hovers over a property until at some point that property is subjected to a fire and then lights on the fire.

Excess Policies.

An Excess policy is also something of a Floater, in its nature and only attaches to insured property to an excess of value that the direct insurance on that property does not cover.

Description of Property.

In drafting the form that shall describe clearly and concisely the property covered, the greatest care should be used. Just what is covered should be made clear beyond question, and not only should the intent of the Contracting Parties be clear in the mind of the framer of the form but the expressions used in drafting such forms should leave no doubt as to what that intent was. There is nothing more annoying to both Insurer and Insured than to have a dispute arise over a loss on the ground that something not defined in the policy was meant to be covered by the form used, but which apparently was not. Policy writers who fall into this too common error, are members of that dangerous class of humanity who "mean well" but do not "do well"! One feature of the form that must always be kept in mind, is that if there is a discrepancy in an insurance contract between the Standard policy provisions and the written form or rider attached, the latter will always prevail because it will be assumed by the Courts that such riders are inserted with reference to the special printed contract to which they are attached, and therefore supercede it. This is another reason for care in drafting any form that is to become a part of the policy contract.

A form in the sense that we are now considering it, namely that of an instrument of description, does not tend to set aside any of the printed provisions of the Standard policy. That function is confined to clauses as we have defined them. Even with this distinction though, the importance of forms is not lessened, for if the form be bad, no amount of modifying clauses can set it right, and can only result in a contract that is full of contradictions. Then too, the Underwriter in considering any risk, first looks at the form and if that is bad, either in the description of the property covered or the way in which it applies, he usually gives no further consideration to the offering, but turns down the whole proposition. Forms present more oppor-

tunity for the ingenuity of the policy writer than clauses, since the latter are usually standard to the extent of every word used in them while forms are necessarily to a large extent, optional, and even where standards are used, in the preparation of forms, it is more a standard of arrangement and classification than of prescribed descriptive language.

In the framing of forms, it must ever be kept in mind by the policy writer that if there is any ambiguity in the expression or description used and litigation should ensue, the Court will always decide in favor of the Insured party where any other than one interpretation is possible. This attitude on the part of the Courts is not unreasonable, since the issues that arise under forms in dispute are always on those designed to protect the Insurer, and if they are doubtful, such doubt might tend to invalidate the entire contract. Then too, the contract is always made by the Insurer and is prepared on the good faith of the Insured.

Forms are seldom drafted by the party who has to adjust the loss for the Company if one occur. This too, calls for care on the part of the policy writer. Words should be used by him that will be as clear to the adjuster and to the insured as they are to the party who framed them. The Standard policy, framed as it was by the best of legal and underwriting talent available, often has its wisest provisions entirely set at naught by the ignorant act of an inexperienced form writer.

An old underwriter once said that "if the Standard policy was drafted in Heaven, the Devil himself must have been the author of many of the forms and clauses that are in use." Experienced adjustors probably have no doubt of this, for carelessly drawn forms cause much to be said and done that will surely tend to swell the ranks of the followers of the Prince of Evil.

The company whose forms are blindly or carelessly drawn, suffers both in the trouble that ensues therefrom, in the business they get and even more from the business that they do not get, owing to the ill reputation they have acquired.

Now, what are some of the evils that result from carelessly drawn forms of property description? Such description must tell what the property is and where it is. This surely seems easy, but how often the adjuster finds himself in grave doubt as to these very features owing to a doubtfully worded form.

Some of the troubles that arise from poor wording of the "what" in a form are the comprehensiveness of the description. In his desire to cover all the insured ought to have covered, the policy writer may draw up a form that can easily be con-

strued to include things never intended to be included, and oftentimes, even those that are prohibited. For instance, the phrase, "stock of drugs" can be held to include gasolene of any amount.

Trouble Breeding Phrases.

"Such other goods as are usually carried for sale" is another description of property that is very desirable to avoid. What does "usually carried" really mean? Take for illustration the contents of a general store. Pretty much everything salable at some time or other is handled in such a store and a form that winds up with the above phrase would hold the insurance company liable for explosives or volatile oils kept, even though it was not the intent of the agent to cover them, even though the insurance company had no idea such hazardous materials were a part of the stock carried, even though the rate on the property was made with no contemplation of the existence of such hazards and even though they might prove to be the direct cause of the destroying fire. The agent who loves to use this broad phrase in order to be sure and get everything his customer has or may have under cover would probably say, "Why, it is not usual to keep such hazardous things, so my form does not cover them." It does though, for even if in some places a special rate is made and an additional premium charged for the extra hazard of their presence, and perhaps they might be clearly specified too in the form, it establishes the fact to the Courts at least, that it is not unusual to find such merchandise kept in the stock of general traders.

"*Usages of their trade.*" The word "usage" is one we often find in insurance forms and one that is easily capable of mis-interpretation. We know that forms devised for special lines of either mercantile or manufacturing business probably seek to conform to the usages of the trade protected, and to consider the special practices and privileges that such trade might require, perhaps these requirements are constant in the business, perhaps they are only occasional or temporary but if necessary to the conduct of the special business to which they apply, the fact that they are temporary rather than constant, does not void the contract. Bar then, whenever possible, the use of this word "usage", as it may be more comprehensive than the poliey writer intended.

This makes it all-important that the policy writer in drafting a form to cover a certain manufacturing plant, for illustration, does not incorporate the phrase, "*and all other materials necessary for their use,*" or "*incident to the prosecution of their business,*" unless he knows absolutely what such materials are and whether they involve hazards not contemplated by his insuring company in issuing the policy, nor features considered

in the fixing of the rate. The same caution should exist in drafting a form covering the insurance allowing the insured to carry on "*such processes as are incident to his business.*" Not only should the policy writer be absolutely certain of his own position and understanding when he uses these expressions, but he should be equally sure that the insured party knows them just as clearly and as fully as himself, and that their understanding agrees. Under such conditions, the use of such articles and processes may lead to no difficulties in the event of loss, without it, trouble is more likely to arise, since "incident to his business" is a very comprehensive phrase.

For instance, suppose you have a form describing a certain manufactory producing advertising novelties. Trade conditions have brought the use of celluloid, often in its most highly combustible form into more or less common use in processes of this sort. A line in the form describing in a general way the property covered and closing with the words, "and all other articles or materials incident to his business" would allow the assured to use this hazardous celluloid, though probably the factory had been rated when no such extra hazard existed, nor from the form used would the Insurance Company realize that they were taking on an uncontemplated hazard. A form like this can only be safe for the insurer when there is an insertion or addition calling special attention to the possible use of celluloid or other hazardous materials.

The use of the words "*merchandise*" or "*contents*" without any explanation or restriction is another most unwise practice in devising forms. What is "merchandise?" Anything in the way of stocks. "Contents" is even more comprehensive, since it may cover machinery as well as any form of stock. So the insuring of merchandise or contents without restriction for any party may be construed to cover anything from pig iron to benzine or from fire bricks to millinery, should the insured elect to keep them! Possibly you think this is too palpable an error for anyone of even moderate sense to write into a policy form or to even think of committing, but as I write this, I have before me a form used in some extent in a nearby state, reading "on all the contents pertaining to or used in the business of the assured, contained in the brick building, situated................, occupied as ware-house and work-room." This is an actual form in use. You will note it does not even specify the business of the assured. Investigation in this particular case revealed the fact that his business was ware-housing, which made the form even worse. Can you think of any class of materials, or any process of manufacture or any custom of trade that such a form would not cover? To submit one like this the broker or policy writer must be either a fool or a knave — to accept it the underwriter is beyond question, the former.

Possibly the broker may say it is duty to get just as much for his insured as he can and to secure for him a form that will cover every possible emergency, no matter what his assured may elect to do. Within reason, probably such attitude on the part of the broker is all right, but where the aim is to over-reach in the manner that is evidenced by such a form as the one just quoted, it reveals a condition too unfair and unreasonable to be recognized. A condition that will shortly regulate itself and enable the broker to provide his assured only with policies of sub-standard, carelessly managed, plunging insurance companies. In the event of loss, also, such a comprehensive, over-reaching, unrestricted form would be sure to create dissatisfaction and not unlikely litigation, since there is also a doubt as to just what such a form really does mean.

Another phrase at times misused in defining property covered is that of "*held in trust.*" This comes in the lines that generally follow a listing of the property described and usually reads, after defining such property, "their own or held by them in trust or on commission or sold, but not delivered." Expounders of the law and adjusters find at times in this, a case for disagreement as to just what this phrase really does mean. It is not strange that this is so, since some policy writers who are probably carried away with the sort of euphonious legal sound of the words used, incorporate them into property forms, where their use was not only never intended but where it is wholly out of place. This phrase can rightfully be used in policies of carriers, ware-house men, commission and other merchants, to show that the assured, though holding the property of others, can secure the full measure of insurance upon all the property insured, whether the title is vested in them or not. The words "held in trust" simply mean that the goods or the property are in the custody or care of the Insured. He may hold them as an agent or in any other capacity, and so long as he is responsible for their care and preservation, the right under these words is granted to him to protect that right by insurance. We might call it a phrase of privilege, since it grants a benefit to the party holding the property even when the title to it is not in his own name. It supercedes the restriction in the body of the standard policy as to the insurable interest being that of sole and unconditional ownership. Were we discussing it separately from the form of property described into which it is incorporated, we would say it was a permissive clause relating to title and insurable interest.

Under these words in the form, the assured can collect the whole amount due under the policy and may return to the real owner the amount due over the insurable interest that he, the assured, may have as agent or trustee. The real owner, even though he may not have known of the existence of the insurance, may rightfully benefit by it after the loss. For illustration, let us take the case of the ordinary commission merchant hand-

ling textile goods. The mills he represents deliver their goods to him in advance of their actual sale being consummated and in many cases the commission merchant makes cash advances to the manufacturer to enable the latter to continue turning out his product. While these goods that are thus being held as collateral by the commission merchant for these advances, are in his custody, it is the custom of trade for him to keep them insured, in fact, he often contracts to do so. They are held by him in trust or on commission. In the event of a loss occurring, such loss must be adjusted with him and whatever recovery is made, is payable to him. From the insurance money received he can rightfully deduct the advances which he has made to the manufacturer on the destroyed goods and remit whatever is recovered from the Insurance Companies over and above the advance to said manufacturer who is, therefore, fully indemnified for the loss he has sustained. This is one of the conditions that arise where due care must be taken to see that double insurance is not effected and that — to carry out the illustration used — the commission merchant and the manufacturer have not both of them taken out policies of insurance on the same property and for a probable aggregate amount in excess of their actual value.

You may ask why we speak so fully of the conditions that arise from the use of the words, "held in trust or on commission?" It is because of their frequent mis-use in forms of property description. A household furniture form or a form covering the contents of a hotel or a church or a school or any other public edifice would certainly be complicated by the insertion of these words, in fact, they would be wholly out of place and uncalled for since the conditions of property held in trust or on commission should never occur in them. To the carrier the warehouse-man and the commission merchant, the attachment of such a form is necessary in order to fully protect the interests for which they are responsible, unless an endless number of policies are issued to care for each individual owner who may have goods in their custody.

Perhaps you may say, what harm can these words in a form do to any policy, even if they are not necessary? Sometimes they doubtless would create no injury, but at others their possibilities as a trouble maker are very great. They are words that admit of other interests and properties being covered, ones that the nature of the insured risk or the interests of its insurers never contemplated. Do not use it then, except where proper and necessary.

These are some of the practices and expressions in forms of property description that if wrongly used may cause disagreement and perhaps serious trouble, features, that in form writing should be used most guardedly and advisedly.

In describing properties for purposes of insurance, see to it that you describe just what is covered, no more and no less and that you do it in the fewest words that are needed to clearly define it. Don't, for example, if you are writing a form on the stock of a hardware store, say "carpenters' tools, saws, planes, chisels and screw-drivers," for all these last are carpenters' tools and the multiplication of descriptive words leads to either careless reading of the form or to the suspicion that among the great number of words used, something is included that should not be.

Never, oh, never allow the word "etc." to creep into a policy form! Did you ever stop to think what a far reaching term "etc." is? If not, ask some adjuster who has run across it in the form on a policy under which a claim has been made, and get him to tell you what the assured thought it covered, since his idea is the one that is quite apt to prevail.

Location of Property.

We have spoken thus far of forms of property description and have sought to call attention to some of the things that good underwriters must avoid. It is not only needful to have the property itself described properly, but its location calls for just as clear a definition. The words "*while located and contained as described within and not elsewhere*" that appear in many policies are just as material to the contract as is the property itself. With varying locations the risk quite likely varies, but whether it does or not, the insurers surely have the right to know where the risk is that they are assuming, for it may be necessary for them to decline an insurance, because they already have a sufficient commitment in that particular locality, also because outside conditions may make one locality undesirable, while the same class of property owned by the same assured in another locality, would be perfectly acceptable.

It has been held that where the policy says, "*the following described property, contained in a certain building,*" further definition of the location is not necessary or material to the contract, if the nature of the property makes it clear that it must have been the intention of the insurer and insured to proteet it by the policy whether in that particular place or not. In that case, a designation of the location is looked upon as being merely descriptive and to be controlled by the necessary use of the thing insured. Conditions are very unusual however, where clearly defining the location of the insured property is not fully as material to the contract as the description of the property itself. In the New York form of policy the words "and not elsewhere" are added to those describing the location. These words are a sort of warranty as to the location, and their use certainly seems desirable even though in the Massachusetts Standard form of policy they do not appear.

The use of the word "*premises*" sometimes leads to misunderstandings in the interpretation of a form. Just what are "premises"? The interpretation of this word in the fire policy seems to vary somewhat in different courts, and unless the extent of the so-called "premises" is in some way defined or restricted, in the policy form, it appears to be so indefinite as to have, in some cases, been interpreted as covering in localities more or less remote from one another, but all forming a part of some one plant. To define just what "premises" are is a puzzling proposition, so only use it with proper limitations or full and clear understanding both on the part of the insurer and of the insured.

Probably no words that are commonly used in forms of property location have caused so much trouble as "*additions and alterations*" and "*adjoining and communicating.*" They may seem clear enough, but it is a fact that our Courts have seen fit to regard them as being sufficiently elastic in their interpretation to admit of entirely unlooked for meanings. The words "additions adjoining and communicating" in a manufacturing plant have been held to cover all buildings which are either added to the main building, and that may be in any way necessary for the complete operation of that plant. "Adjoining and communicating" is not always held, by any means, to require that the buildings under consideration necessarily touch each other. In fact, the words "adjoining and communicating," when made use of in describing the buildings of a manufacturing plant have been held to cover any building that is essential to the conduct and operation of the business, even when quite remote.

Usually we think of the words "adjoining and communicating or connecting" as meaning that the buildings referred to are actually built into or attached to one another. One of our New England Courts held that a certain dry-house at quite a distance from the main plant, but connected to it by a steam pipe, constituted such a communication as was contemplated in the policy and the insurance companies were compelled to pay a loss on this dry-house, which they had clearly understood was not in any sense covered by their policy and not included in the rate. In fact, it was separately and much more highly rated.

It is difficult to give a general line of guidance or instruction in the use of these words, and the most that we can say is that before you use them, stop and think as to what the broadest interpretation that might be given them along the lines which we have cited, would cause the Company to be called on to contribute for. If in a general form covering different buildings, this phrase is used for the sake of convenience to

make it more comprehensive, while it is intended not to cover certain particular buildings, the exception of those particular buildings should be distinctly noted.

In defining locations probably the simplest policy forms and the ones most frequently written, namely those applying to dwellings, present more instances of carelessness than any other class. "East side of Main street in the town of So and So," is surely an indefinite description of a location when Main street may be several miles long and in the event of a certain party owning several dwellings on the East side of the street, there is nothing to hinder a single policy paying tribute in the event of loss, for any one of these dwellings. Descriptions of this sort are by no means rare, but are not the less reprehensible.

Another phrase that is commonly used in forms of property location, presents a feature of carelessness that makes one wonder that it is not taken exception to more frequently by the underwriter. I refer to the use of the words "*all while contained in.*" You know how many forms that have described merchandise, or building contents of some sort or other, end with the words, "all while contained in," and then proceed to describe the enclosing building and its location. I think you will agree that this does not really limit the liability of the Company to the merchandise or other property covered while in that particular place. To be thoroughly safeguarded, it should read, "*only while contained therein and not elsewhere.*"

Improvements and Betterments.

Before closing these comments on forms of property description and location, I again want to urge upon you, the need that there is for your always regarding forms or permits or clauses as being something that modifies the standard policy contract and in order to make it conform to some especial usage of trade or to grant certain privileges that are essential to the needs of some particular ownership. Do not regard the whole policy as being represented by the provisions embodied in the forms or clauses attached, but remember that these additions are supplementary to the policy contract itself, and while their provisions must supercede those of the body of the policy, yet they are dependent upon same and they must never be considered irrespective of the standard provisions in the policy itself.

Avoid Unnecessary Charges.

Where forms have been well tried out and have been found to work no injustice to either insurer or insured, but which clearly define just what the nature of a certain risk is and just where it is located, do not seek to continually change the form other than as it may be necessary to describe the actual property

insured and the place in which it is insured. In the general use of the various phrases that are so often in dispute, some of which I have spoken to you about, stick closely to the old prescribed forms and don't get the idea that you are doing a brilliant act if you invent some new form that may or may not prove acceptable. Remember, when you are inclined to find fault with a form that has been in use a long time and has in the main proved equitable, that "*'tis better to endure an ill than fly to evils that we know not of!*"

Standard Policy—Clauses and Forms
Third Paper

BY

WILLIAM B. MEDLICOTT.

Forms for other than Direct Fire Loss

In our last lecture we confined our attention to fire insurance forms of property description and location. You will also recall that in beginning this course of talks, we defined forms as those attachments to the policy which were descriptive in their nature, and we mentioned the fact that forms not only described the property covered and the place in which it was located, but they might also define the nature of the insurance carried in the event of its being other than against direct loss or damage from fire.

Use and Occupancy, Rent, Leasehold Interest, and Profits Insurance.

We define attachments of this sort as being "forms for other than fire liability," such as use and occupancy, rent, lease-hold interest, profit insurance, etc. It is my purpose to-night, to bring forms for insurance contracts of this type to your attention and the subject is one that I approach with hesitancy. I recall some 15 years ago at an insurance banquet, that an address was given by one of the oldest and most experienced fire insurance company presidents then in active business. In the course of his address he stated that he had been recently asked as to who understood use and occupancy insurance. His reply was that he believed that a few special agents knew something about it, but not a single head office official! I am fully justified in believing that at that time I was not one of the few special agents referred to, and with the increasing complications and perplexities that insurance contracts of this sort present, I begin to wonder whether I do not, after all, really know less about insurance of this class now than I believed I did then. So you can see that insurance of these varied forms, presenting as it does, problems vastly different from those embodied in the direct fire loss contract, and also considering that up to date, the experience of the companies writing this class of insur-

ance is a somewhat limited one, naturally causes statements made in regard to it, to be uttered with more or less hesitation.

We have, however, gone far enough with it to know that there are certain conditions that must be carefully avoided and it is my hope that in this discussion tonight your attention may be called to them, and that, if we accomplish nothing more, you will be brought into an attitude of mind that will cause you to think carefully of these varied forms of insurance whenever you have occasion to study, devise or pass upon them, and will be able at least to avoid some of the common errors that so easily creep in.

Use and Occupancy Insurance.

The most common of the forms we have mentioned is that of "Use and Occupancy." Now, what is use and occupancy insurance? Just what does this title, "Use and Occupancy," really mean? Many circulars have been issued defining it, and while in the main they agree, still a recent experience of my own with parties taking out contracts of this character and who had sought advice through various sources, revealed the fact that it is very easy for the insurance man, in seeking to define and explain just what a use and occupancy contract covers, to unintentionally mislead his customer.

The natural tendency with any man in explaining a somewhat complicated contract of this sort, is to magnify its efficiency and with thoroughly good intentions, and usually with great largeness of heart, to make it appear to cover many things that the underwriter never contemplated insuring against.

Let us, from the combined wisdom of those who have written on this subject, and the experience of others, try and give a condensed statement of the province of use and occupancy insurance. Some state that its object is to make good the loss of "profits" that are consequent upon the shutting down of a manufacturing plant by fire. Others state that while it is not primarily designed to insure profits as such, it is to insure the results of production in the sense that product is regarded as income from process of operation.

In the event of a shut-down as the result of a fire, this product and income largely if not entirely ceases, while, at the same time, there are always certain fixed charges and expenditures which have to be kept up in order to maintain the organization in such a condition as to not only hurry forward the needful repairs and re-instatement of the damaged plant, but also to place the same on an operating basis as soon after its completion as possible. For illustration, interest on indebtedness that the concern may have outstanding, continues to work whether the plant runs or not, taxes are seldom materially abated as a consequence of a fire; royalties for special machinery

usually continue in force; salaries of those who are under term contracts with the concern; the wages of watchmen, firemen, engineers, costs of lighting and heating, and, in fact, you can readily think of numerous other fixed charges, which if it is the purpose of the assured to restore his plant and continue in business as promptly as possible, must be continued in order to enable him to resume a condition of satisfactory productiveness at as early a day as possible. Meantime, through the intervention of fire, the income — the funds coming in from the business that are looked to to care for these fixed charges — has ceased.

It seems to me then, that those who define use and occupancy insurance as covering profits even in the remote sense that some writers use the term, rather misuse the term and are likely to mislead. It is a continuance of product, it seems to me, that use and occupancy insurance guarantees, in the sense that when a plant is producing goods or when business activities of any kind are being conducted within its confines, whether manufacturing or not, there is a result obtained that brings in through the disposition of that product, of an income to meet the expenditures connected with manufacturing whether they result in a profit or not. Do not think from this that I would consider a plant that was running without making a profit as a desirable subject for a use and occupancy policy but even assuming that it was operating on a highly profitable basis, the use and occupancy contract should not be construed to make good the loss of that profit which would result from a fire and a termination of the processes of manufacture or trading and the consequent gain resulting from them.

There are many losses that result from the shut-down of a plant or store during its periods of activity, aside from those we have spoken of and the money derived from the insurance carried under the use and occupancy form has been found again and again to be the only available fund which could be used to lessen the period of inactivity or to carry on the business temporarily while the rehabilitation of the destroyed plant was being carried on. This latter view of the situation is tenable, when we consider that under a use and occupancy policy, the sum of money paid over to the assured has oftimes enabled him to either engage temporary quarters or to lease some other plant and in that way to continue to supply his customers and hold his business, during the same period that his fire policies are re-building, re-equipping and re-stocking the destroyed plant.

One of the first questions that presents itself to the underwriter, and one that should be carefully considered by the assured as well, is as to who are wisely eligible for policies of this sort and for what amount may they be written. As a general principle, it may be stated that only concerns of unquestioned

standing and accounting methods should ever be considered in writing insurance of this sort. Some companies go even farther than this, and in order to render the likelihood of a total loss under a use and occupancy policy as remote a thing as possible, confine their writings strictly to sprinklered risks. This latter point is, of course, wholly discretionary with the underwriting company, but the first feature mentioned, that of high standing and efficient bookkeeping, should be always required of those seeking insurance of this character.

I do not know that there is any rule adhered to by the insurance companies as to the proper amount of a use and occupancy policy with reference to either value of the property or the amount of business transacted by the assured. Some have adopted a form calling for 90% of the net income; this would appear to introduce the profit feature, and, in any event, to raise a doubt as to just what "net" income was. As a general proposition I believe that about 10% of the annual business of a concern is a reasonably fair average line of use and occupancy to carry, and experience would seem to bear out this, since the average amounts carried run not far from this percentage. Let us take the case of a certain concern that comes to my mind at this moment; its plant is valued at about $400,000. They are carrying fire policies to the extent of 90% of that value. The annual business averages a million a year. After careful consideration, both underwriter and assured agreed that $100,000 use and occupancy was just about the right amount to carry.

Conditions of construction, the nature of the business, the frequency with which the stock is turned, the protective devices in use on the property, all have their bearing on both the desirability and the amount of the use and occupancy policy, and the rate at which it should be written, and as experience grows riper, on dealing with contracts of this sort, doubtless more definite rules will be formulated for the guidance of the agent and the broker seeking use and occupancy contracts, but at present, we are largely feeling our way in the dark, though experience has proved that the enterprise thus far, not only has been a reasonably profitable one, but also promises well for the future.

Cases often arise in manufacturing plants where a use and occupancy contract may rightfully be drafted to cover other than the manufacturing or producing buildings. Storehouses that contain the product either in an incomplete or a finished state, may properly be covered since their destruction or the loss or injury of their contents will just as effectively shut off the output of the mills as a fire in the producing portions. A lumber yard directly connected with a plant using wood as one of its raw materials may rightfully be included, in the same way that a storehouse might.

In the case of a mercantile business, the store where the actual business of distributing is conducted or the storehouses on which such store depends for its immediate needs are also fit subjects.

As to the question of rate, at present, as you know, fixed tariff rates are not universally promulgated on insurance of this class. They are purely discretionary with the underwriters. Investigation reveals that they run one-half to three-quarters of the regular fire rate. In occasional cases, they fully equal the latter, but we probably are not far out when we say that the great bulk of use and occupancy insurance written today, here in the east is written at about two-thirds of the fire rate. Whatever the rate is, it must be modified largely by the conditions that exist in the plant, not only as to the likelihood of a loss, but the ability to confine that loss within small limits and also such arrangements in the plant as make it probable that a fire will result in but a temporary shut-down at the most.

Use and occupancy policies are written not only with a limitation as to the maximum amount payable thereunder, but with a stipulated per diem contribution which shall continue during the period of shut-down in the event of a loss occurring. This feature of the use and occupancy contract is the one that probably has created more discussion between insurer and insured than any other in connection with this class of insurance. For example, suppose a man takes out a use and occupancy policy, of $3,000 on his factory. We always assume that there are 300 working days in a year and that, therefore, $10 a day for each working day would exhaust the policy in question. But the assured will say, "at the most, I can't be shut-down over 4 months. Why then shouldn't I get instead of $10 or that is one three-hundredths of my policy per day, one one-hundredths since there are about 100 working days in 4 months. In other words, why shouldn't my contract give me $30 instead of $10 a day during the period I am shut down?" A contract drawn in this way and granting this more liberal per diem contribution, would certainly be a valid one if an insurance company saw fit to grant it but it would be unjust to ask any company unless they were to receive a very materially higher rate, to accept such a contract for a year. Suppose the assured chose, in the illustration used to take out his policy for 4 months and paid a rate accordingly, because he would probably say: "I can have my plant going again under any conditions, in that period and I don't need a use and occupancy policy for a longer term than that." Such an arrangement, if a company saw fit to grant it, would be all right, but they certainly should be paid a very materially higher rate. You will all admit, I am sure, that to take such a contract for a year

with the likelihood that cessation for a small part of that year might completely exhaust the policy, is an underwriting proposition that cannot commend itself to any careful insurer.

Other features must be considered in discussing use and occupancy insurance, and these are especially provided for in many of the use and occupancy forms by stating the method that shall be adopted in determining the actual effect on the business owing to a cessation of working power. A good illustration of this is the case of use and occupancy insurance that is written on street railway properties where the income varies very materially between the summer and winter months. In properties of this sort, it is customary when taking out use and occupancy insurance to specify in the form that as a basis for the computation of daily income, there shall be taken that of the corresponding period of the previous year. Suppose that owing to a fire in its power plant, for example, a certain street railway was unable to operate its cars during the entire month of July, July averaging probably as one of the heaviest months in the annual business of the road. Now, it would not be fair to take the average monthly business for the entire year as being the loss sustained, and, therefore, a form such as the one we are speaking of would require the determination (which could be readily shown from the books of the assured) of the business of the preceding July, which would be taken as a basis for the amount and damage to its business sustained by the road and would furnish data from which to figure out the contribution by the use and occupancy policies.

Some use and occupancy forms, in addition to the provision just described, insert one stating that increased or decreased daily or monthly production, owing to growing or a falling off business condition, may also be considered in arriving at the actual loss of output.

Some lines of business, owing to trade or climatic conditions shut-down entirely for certain months in the year and the same treatment is necessary to equitably adjust their loss that is used in the street railway illustration we have cited.

The general experience of companies writing use and occupancy insurance indicates that it can safely be written at figures related to the fire rates in the proportion we have mentioned. This, however, we must confess, is still very largely a matter of conjecture, since loss costs and averages are very difficult of determination in insurance of this class and have not as yet been derived from a sufficiently wide experience to really make them of established value. I want to emphasize again the great importance of careful consideration of the individual premises and the financial condition and accounting methods of its owner that is insured under any use and occupancy policy. Is the plant one that uses standard machinery and appliances that are readily obtainable, or is it one that is wholly dependent on the output

of patented devices that are slow of construction and that are only built when definitely required? Conditions like these make all the difference between a short shut-down and rapid re-placement or a long and tedious wait. The same conditions apply to the building to be replaced. Is it a frame structure that can quickly be rebuilt, and that has not special features in its arrangement or is it a brewery, for example, that necessitates slow building methods and special arrangements adapted to its processes? Are the assured's books well and clearly kept, and can products and income be readily and accurately determined?

In an industry that is dependent upon large power for its operation, is the power plant so built and arranged that it could be easily crippled and shut down the entire premises? Still further, is the nature of the power used and the way it is used, such that it would be easy or difficult to install and connect temporary engines or motors in order to get the plant under way? All such points must be taken into account by the careful underwriter in considering not only the desirability of use and occupancy insurance, but the rate at which it may be written. In this connection let us say that it is to be hoped that the time is not far distant when there will be more data on file that will show the actual results. At present rates, insurance of this class appears to be fairly profitable, both as to the ratio which the losses bear to the premiums received, and that more important item, loss cost, which is the ratio of the loss sustained to the total amount insured.

Before giving illustrations of some of the forms of use and occupancy insurance that are desirable and some that are bad, I want to take up briefly those other classes that are, in a certain way insurance of the same sort, such as rent, leasehold interest, and profit. It seems better to speak of these before passing on to use and occupancy forms, since there is a tendency, as already stated, in the minds of many to mix the functions of use and occupancy insurance with one or more of these other classes, according to the nature of the risk insured.

Rent Insurance.

This class of insurance, although of rather recent origin, has grown to considerable magnitude and is being regarded with more and more favor, both by the insurance companies and their patrons. When it is properly written, it proves both equitable and fairly remunerative. The reasons for this are that properties that are considered fit subjects for insurance of this character and to which its operations have thus far been confined, are almost invariably under both police and fire department protection, and, what is more important, property that is eligible for rent insurance, represents a greater freedom from

moral hazard. The reason for this is that rented properties are usually under the control as well as the occupancy of tenants and are not freely accessible to those who might directly benefit by a fire. Again, the measure of damage resulting from a loss under a contract of this character is very easily ascertained and owing to this, a better salvage is often secured than results from a loss on either buildings or on other property.

There are many forms under which rent insurance is written, forms of varying length, some clear, some ambiguous and the tendency appears to be on the part of some brokers specializing on insurance of this sort, to continually broaden the contract in order to make it more attractive and thereby secure the placing of more insurance of this character for themselves. Both experience and litigation have had a good effect on the drafting of rent insurance forms. Whatever form is used, the same obligation that we spoke of under forms of property description should always be kept in mind. The intent of the parties should be clear and it should be defined beyond a doubt that the policy is to cover on the rents derived from the building at the time of the fire. To insure this requires co-insurance to the extent of the actual rental, but it should not in my opinion cover the income that might be derived from properties unrented at the time of the fire. We call your attention especially to this because there is a growing tendency on the part of some form drafters to make a rent form cover not only the actual rents that are lost by the fire, but to use without restriction the phrase "rental value," basing the income thereby on the total rent that would be obtained were the entire property rented. You can readily see that with such a form, old, undesirable and unpopular buildings might receive, through rent insurance, a far greater sum than the actual loss of rents which the owners had sustained from a fire.

A form that it seems to me covers all that a rent form should, might be worded as follows:

"It is understood and agreed that in case above named building or any part thereof, shall be rendered untenantable by fire, this Company shall be liable to the Assured for the actual loss of Rents ensuing therefrom, based on the rentals in force from the rented portion of the premises at the time of the fire and not exceeding the sum insured.

"Loss to be computed from the day of the fire for the time it would require to put the premises in tenantable condition, and not to be limited by the expiration of the policy, excluding from such time, such portion thereof as may be consumed by a strike or by any other delay beyond the control of the Insured.

"In consideration of the reduced rate at which this policy is issued the Insured stipulates and agrees to carry insurance on said rents to an amount equal to the actual rents of said premises, and it is understood and agreed that if at the time of the fire, the aggregate insurance upon said Rents shall be less than the actual rentals at the time of the fire, the Insurance shall be held to be an Insurer in the amount of such deficiency, and in that event shall bear such proportionate share of the loss."

You will note from this that while the object of rent insurance is to indemnify a landlord for the loss of income that would come to him through a fire, and is in a general way insurance of the same class as use and occupancy, still there is a wide difference in that the rents lost are definitely ascertainable, while with the use and occupancy there is always an element of uncertainty as to just the extent of the damage and the necessary contribution therefor on the part of the insurance companies.

You will furthermore note that while rent insurance, if properly written, should always be accompanied by a clause fixing the amount of insurance to be carried with respect to total income or business, a use and occupancy policy could not properly be subject to such a restriction.

Leasehold Interest Insurance.

Insurance of this character covers more varied interests than are involved in rent insurance. It necessarily, therefore, becomes more complicated. Leasehold interest insurance not only insures the middleman or lessee, but it also insures the profit between what he would pay the owner of the property and what he may receive from tenants to whom he sub-lets the same. Again, it may insure his interest as lessee, and yet again, it may insure his interest in a building which he may erect on leased ground. The fact that such a variety of interests may be brought forward under a leasehold interest policy, necessarily raises many features, and some of the objectionable ones are the following:

Contracts often exist between the landlord, that is the real owner of the property, and the lessee which are not divulged by the policy and the provisions of which the insurer and even the broker, placing the line, may be in absolute ignorance of. This difficulty might be overcome by the use of a proper form, but it is a fact that it has frequently been the subject of tedious and more or less expensive litigation. Many leasehold forms for attachment to insurance policies, contain a clause like this:

> "It is a condition of this insurance that this Company is liable only in case of such destruction by fire, of the above named premises, that the lease held by the Insured shall, by its terms be cancelled. The Company then shall be liable to pay the amount hereby insured."

This you will note, refers to a contract that is not set out in the policy which at times presents objectionable and dangerous features for the insurance company.

In some cases the following phrase is used:

> "In case of the destruction of the premises by fire, this lease shall cease and be terminated."

Under this clause if the term of the lease would not expire for say, 3 years and the building should be replaced in tenantable condition in 4 months, the lessee could collect from the insurance company for 3 years rent, if he had insurance amounting to as

much as that, wholly regardless of the time that it actually takes to replace the damaged property. The Courts are having continually presented to them for adjudication, features that were never contemplated by either party to the contract before the fire, but which have been raised at the instigation of some attorney brought into the settlement of the loss claim. It is difficult to draft a leasehold form which will cover all cases, and the only wise suggestion that can be made is that forms used in leasehold interest insurance should be prepared with great care and should always be regarded from the standpoint of an occurred loss thereunder.

Another and most important feature of leasehold interest, and one that calls for the closest of scrutiny on the part of the underwriter, is that insurance of this character is very easily and not infrequently tainted with moral hazard, especially if the lessee desires to rid himself of a bad bargain. The possibilities of making money fraudulently out of an opportune fire under a policy of this kind, where premises leased did not sublet to advantage, are very fertile ones.

Profit Insurance.

Insurance of this character is comparatively new and it presents features that a good many companies object to and many absolutely prohibit. A profit insurance policy is a dangerous instrument to put into the hands of any but the most reputable and reasonable of assured. In itself it creates at once a moral hazard which, while it may not be recognized as such by the honest manufacturer or merchant, still does exist, and to those in the business whose virtue is of a less rugged type, it presents a constant temptation to make sure of a greater profit than the conditions of the business warrant. It matters not what the nature of the business is, similar conditions exist under insurance of this form. The fire insurance policy which the assured carries will make good to him the loss of the plant which he is operating, as well as of its contents of every character, and if we add to that the assurance that the profit on all of his unsold merchandise will immediately become his in the event of a fire, we must admit that the temptation placed before the manufacturer or merchant, in times of slow business and poor trade, is one that weak humanity is sorely tempted to avail itself of. Many people would view with comparative equanimity, the destruction of their property, provided it is well protected by a fire insurance policy, but they might be sorely disturbed if at the same time, the profit which they had expected to receive from merchandise in their hands was taken away from them and at this point profit insurance steps in and virtually says, "why lose anything?" Why not regain your lost plant, and in addition, all of the benefit that would have

come to you from the conduct of a profitable business?" Still further is the increase of hazard created where slow moving stocks, old styles of merchandise and seemingly unsalable articles form a large portion of the assets of the business.

Profit insurance, therefore, can only be written with safety by confining it to successful, live concerns of established reputation and financial worth, and even then it would not appear amiss to incorporate a clause in the policy specifying that in the event of any loss, a fixed percentage of the profits should be the limit of the claim to be made under the insurance, much in the same manner that the three-quarter value clause is applied in writing certain properties. In addition to this there should be an adequate co-insurance clause attached which should definitely fix the relation between the amount of insurance carried and the total profits derived from the business for the period of the insurance. Under any condition, insurance of this character should never be written for concerns or individuals whose system of bookkeeping is not of such a definite character as to show clearly the business conditions, especially as regards the profit made.

The Danger of Confusion.

So much in a general way for these four kinds of insurance that are closely allied to the direct fire lines. To me it seems as if one of the dangers attendant on writing these classes of other than fire insurance was a tendency to mix their various functions and one or two illustrations may serve to bring that condition more clearly to your minds. I have before me a use and occupancy and "expense" form issued by one of our best known and most successful companies, which reads in part:

Some Irregular Forms.

"$............ On the Use and Occupancy of building and machinery of............situate............and occupied............ If the said building and its machinery equipment be destroyed or so damaged by fire as to necessitate the total or partial suspension of operations, this Company shall be liable under this policy for loss of net profits on goods, the production of which is thereby prevented."

The feature of this form to which I want to call particular attention is in the above use of the words "*net profits on goods*," for there is no qualifying clause in the remainder of the form that indicates that the use of the word "profits" is other than the ordinary understanding of that word. If the insurer and the insured know exactly what this form means and are willing to accept it, there would seem to be no objection to its use, but I fail to see how it can rightfully be termed a use and occupancy contract.

Another somewhat puzzling and vague form that we run across occasionally masquerading as a use and occupancy contract, is that which is especially designed to cover goods that are exhibited at some exposition or fair. I have before me one that is designed to protect the exhibitor for one week, that is, a period of six exhibition days, and it reads as follows:

"$............being this Company's pro rata share of the agreed expense and profit of Assured incurred and arising from the carrying on of an exposition or show in the............building, located............ ...., it is understood and agreed that if by reason of fire in the above mentioned premises, the Assured shall be prevented from carrying on the show for the full time specified in the contracts with exhibitors, advertisers, or others, then this Company shall pay to the Assured its pro rata share of the agreed profit and expense on said contracts, or the uncompleted portion thereof. It is further understood and agreed that in the event of fire so damaging the building that the Assured shall be prevented from carrying out his contracts, then this Company shall pay its pro rata share of the agreed amount of expense and profits, it being understood and agreed that for the purpose of this insurance, the amount of expense and profit is valued in the sum of $............ provided however, that should the fire occur after the date of the opening of the fair, then this policy shall be subject to deductions of 1/6 per diem for such time as shall have elapsed between the day of the opening of the fair and the day of the fire."

It is hard to define just what this form is, "expenses and profits" and some of both. It certainly is a legitimate contract if an insurance company can be found ready to undertake it, and I do not doubt that there are those that will gladly do so. Surely it is a very desirable policy for the exhibitor to hold, since so far as its protecting him goes, he has very little to worry about in case the premises burn up during the exposition. He doubtless has fire insurance to pay for the direct loss of his exhibits, and his labor and expected profits in exhibiting them would be cared for under such a contract as the above. In fact a fire would be as good as the show, possibly better. From the insurance standpoint, such a form must be regarded like the horse about whose merits a prospective purchaser asked Abraham Lincoln's advice, — "If a man likes that kind of a horse, that is the kind of a horse he would like!"

To my mind, the important features in a use and occupancy contract are embodied in words like the following:

A Good Use and Occupancy Form.

"It is agreed that if by reason of fire on the premises above described occurring during the continuance of this policy, the building and/or machinery or other movable property therein or any of them in whole or in part to be destroyed, or so damaged as to entirely suspend the production of finished goods, then this Company shall be liable at the rate of 1/300 part of the amount of this policy per day for each working day of such prevention and in case the said buildings and, or machinery or other property therein, in whole or in part be so damaged as to prevent the making of the full daily average production of finished goods, then this Company shall be liable per day for that proportion of 1/300 part of the amount of this policy which the said production so prevented bears to the full daily average production of finished goods.

"In order to determine the full daily average production of finished goods, the average daily production for the corresponding period of the previous year shall be taken, subject to such increase or diminution as charges in the capacity of the plant or condition of the business shall warrant, but not to exceed in any case, the amount of this policy.

"Loss if any, to be computed from the day of the occurrence of any fire to the time when, after the adjustment of the loss on the above described property, the said premises could with reasonable diligence and despatch be replaced and the machinery installed therein, but not to be limited to the date of expiration named in this policy."

The above agreement seems to me to cover everything that can reasonably be expected from insurance of this sort. It makes no mention of profits, but it aims to make good the loss of producing power to the extent that such production is curtailed, which is, to my mind, the legitimate object of use and occupancy insurance.

This form is a combination of a number of forms in use by large manufacturers and merchants. The phraseology of course, in the case of the latter having to be changed somewhat to accomodate itself to the difference between trading and producing.

A Good Rent Form.

We have already, in speaking of rent insurance, given an illustration of what seems to me a good form. Another that appears to present the features that can justly be considered, might read:

"$............on the Rents of the............building while occupied............ situate............

"It is understood and agreed that if said building or any part thereof shall be rendered untenantable by fire, so as to cause an actual loss of Rents to the Assured, this Company shall be liable for such loss of Rents not exceeding the sum hereby insured.

"The Assured agrees to rebuild or repair said building in as short a time as the nature of the case will admit and the sum insured will be taken as the yearly rent of the building and this Company shall be liable only for such proportion of any loss as the sum hereby insured bears to the annual rent of said building.

"Loss to be computed from the date of the fire and to cease upon the building being again rendered tenantable. In case the Assured shall elect not to rebuild or repair, then the loss of Rent shall be determined by the time which would have been required for such purposes."

Then follows an agreement for arbitration in the event of disagreement over the time required.

This form properly protects the assured and is a clearly understandable contract on the part of the insurer. There is a tendency, unfortunately, in some localities to broaden these rent forms materially, and I have before me one that is not satisfied with the actual loss of rent, but inserts in a rather obscure manner the words already referred to and reading "or rental value to the assured."

A Good Leasehold Interest Form.

A leasehold interest form that embodies what seems to me the proper features for insurance of this kind would read:

"$............on his leasehold interest in the............building occupied, ...situate............

"It is understood and agreed that this insurance is intended to indemnify the Assured against loss of revenue from rents received in excess of amount to be paid by him to............under a certain lease of said premises dated............day of............for............years at the yearly rental of............

"In case of the total destruction of the premises, thereby vitiating the above mentioned lease, then this company agrees to pay the whole amount of this policy, less an amount for the expired part of the year, which amount for the purpose of this insurance, will be calculated at the rate of $............per annum from the............day of............

"In case of the partial destruction of the premises by which the lease is not unimpaired, then this Company will pay the amount of Rent so lost not exceeding the rate of $............per annum in excess of amount paid to the lessor or owner, during the time the premises are untenantable."

Then follows the arbitration clause in event of disagreement.

This form may seem somewhat cumbersome, and I have before me several specific forms relating to certain particular properties that in certain of their details are possibly more explicit, but the general points that should be clearly understood by both parties to the contract in entering into an agreement of this sort, seem to me to be well and definitely fixed by the form as cited.

A Good Profit Insurance Form.

A form applicable to insurance of this kind can easily be very brief and at the same time fully explicit. In fact, a form like the following, would seem to me to reach adequately almost any case that might arise.

"$............on the net Profits derived from............business as dealers in............contained in building situated............on profits from their stock in trade, their own or held by them in trust or on commission or sold but not delivered.

"In case of total loss by fire, this Company shall be liable for the amount hereby insured.

"In case of partial loss by fire, this Company shall be liable for such proportion of the amount hereby insured as the value destroyed bears to the average daily value of said stock for the year preceding the date of said fire, subject, however, to variations in values and profits as shall result from changes in the market prices of materials, supplies and manufacturing processes."

This form is absolutely clear in all of its provisions, and it certainly serves to bear out what we have already said in speaking more particularly of profit insurance: namely, that its safe prosecution is wholly dependent on the evidence of satisfactory bookkeeping on the part of the assured, and of a healthy business condition revealed thereby.

Sprinkler Leakage Insurance.

Before we pass on to forms covering in extended areas, I want to call your attention to one other increasingly common form of insurance against other than direct fire loss. There is an old saying, or proverb, to the effect that there is no great loss without some small gain. In the class of insurance I want to call your attention to for a moment, this proverb might be reversed so as to read "There is no great gain without some small loss." The installation of automatic sprinklers results, not only in greatly safeguarding the property of the assured and minimizing the losses that otherwise would come to him, but also it enables him to secure a very much lower rate. The benefits certainly are great, but with this great benefit and saving there is a small element of danger and possible loss.

Insurance for loss that may be caused by the leakage of an automatic sprinkler system is becoming more and more of a necessity as installations of these systems are growing more common. Fortunately, the mechanical devices, not only in the sprinklers themselves, but in the way they are attached and supervised, have improved so greatly that the percentage of claims caused by sprinkler leakage is a steadily decreasing one. Accidents will happen though, water hammer in the pipes may cause a weak sprinkler to slowly develop a leak, an accidental blow either from broken machinery or the careless handling of a ladder, or any other movable appliance may break one of the sprinkler heads off. Or, and perhaps this is the most frequent cause of sprinkler leakage, freezing of the water in the system will cause broken pipes and strained sprinkler heads. It speaks well for sprinkler equipments that these mishaps are infrequent but the danger is a present one and at rare intervals damage occurs that must be made good by insurance of some sort.

Since sprinklers are directly promoted by the fire insurance companies and are the means of greatly reducing the losses that come to them, and since their installation and maintenance are indirectly supervised by these insurance companies, it is only proper that these companies should guarantee freedom from loss on insured properties through accidents to the automatic sprinkler system from other agency than that of fire.

You are doubtless aware that the damage that may be caused by water discharged by a sprinkler opening in the event of a fire, is as much covered by the direct fire policy as is the damaged caused by the fire itself. We are now considering the damage that may result from a sprinkler discharging owing to some other cause than that of fire. It is this emergency that we wish to guard against, and by the use of a proper form in the policy contract, liability of this sort may be assumed.

Before we take up such forms in detail, there are certain features which must be carefully taken into account in the writing of sprinkler leakage insurance. For instance, the amount that it is proper to carry under a policy of this sort. The general practice, I believe, is that where sprinkler insurance is carried, it should be so carried as to not exceed 5% to 10% of the amount that is insured under the direct fire policies. This is assuming that the insurance under the fire policy represents at least 90% of the value of the property covered. Conditions will vary with different risks, the points principally taken into consideration being, what is the greatest damage that could result from the accidental discharge of any one sprinkler, owing to the arrangement of the building and the distribution of stock and machinery? You can see readily how necessary it is to take these conditions into account, and also how unlikely it is that more than one sprinkler would meet with accident and commence discharging at the same time.

Companies writing insurance of this character have no fixed tariff, but each contract is made at a price based on their individual judgment, after full information regarding the property to be covered has been secured. The construction, arrangement, and height of the building should be known, the heating and lighting appliances, the make of sprinklers, the time they have been in service and the presence and efficiency of an automatic alarm system, one that will operate by the motion of the water through the system and not be dependent solely upon the action of heat. You can readily see that a condition of sprinkler leakage brings about a state of affairs where the ordinary thermostat system or heat alarm would not be effective, while a rotary alarm operated by the motion of the water in the pipes would give prompt notice that there was a discharge at some point which would call for immediate attention. So far as we can learn, the general situation over sprinkler leakage insurance is that the same is usually written to about the extent of 5% of the value of the property covered with a varying range of rates, probably averaging not far from ¾ of 1%.

Some companies have charters sufficiently broad to enable them to write insurance of this character, while others are restricted in this respect and cannot undertake it. Competition, and especially the attitude taken by the Mill Mutuals has caused more and more of the stock companies to include insurance of this character among their writings.

The form for sprinkler leakage insurance issued by the Manufacturers Mutual Insurance Companies ordinarily reads as follows:

Mutual-Sprinkler Leakage Form.

"To.................... of.........................

"In consideration of the maintenance of an automatic sprinkler system for the prevention of loss by fire upon the property insured by Policy No..............of the............Manufacturers Mutual Insurance Company of............

"The said Company does also insure the party thereby assured against all loss or damage that may occur from the accidental leakage of the said sprinkler system, upon the property insured against fire by the policy above mentioned, while the said fire policy continues in force and no longer, but this policy does not cover damage to a reservoir, tank, pipe, or other apparatus, by whose failure the leak is caused.

"Provided that this Company shall be liable for only such proportion of the sprinkler leakage loss as the amount insured on said property against fire by the Policy above mentioned bears to the whole amount of fire insurance thereon.

"Provided also that the total amount of insurance under this Policy shall not exceed the amount of the fire insurance policy above mentioned."

Following this form is a paragraph providing for conditions of cancellation.

Stock Company Sprinkler Leakage Form.

A form commonly used by the stock companies for insurance of this character reads as follows:

"Does insure............for the term of............from the day of............ 19........, at noon, to the............day of............19............at noon, to an amount not exceeding............dollars, to wit: Against all direct loss or damage caused by the accidental dicharge or leakage of water from the automatic sprinkler system, including tanks supplying it, except as hereinafter provided, in or on the buildings now erected and occupied wholly or partly by the assured (whether the accident occurs in the portion occupied by the assured or not), described and located as follows:............

"And the Company shall be liable under this contract for all direct loss or damage sustained by the assured occasioned by such discharge or leakage, provided same is caused by any accident (including freezing), and applying to all property, real or personal, owned by the assured, or to the property of others held by the assured in trust or on commission or sold but not removed, and for which the assured is legally liable, while situate upon the premises above described, but this Company shall not be liable for loss or damage occasioned by such discharge or leakage when such discharge or leakage is caused by fire, lightning, earthquake, explosion, invasion of foreign enemies, civil commotions, riots, any military or usurped power, order of civil authority, or any fraudulent act of the Assured. It is further understood and agreed that the entire liability of this Company under this contract shall under no circumstances exceed the sum insured, for any loss, claim, or damage whatsoever, and that this Company shall not be liable under this contract for any loss or damage to the automatic sprinkler system itself."

Oftentimes this contract is followed by numerous clauses regarding certain exempted properties, permits for alterations, a description of the method to be followed in the event of loss, and the filing of a claim thereunder. Also, provisions for the manner in which such a policy may be cancelled.

You will note that in the main, these two contracts of the mutuals and of the stock companies are essentially the same though the phraseology varies somewhat. The mutual form

eliminates damage to reservoir, tank, pipe or other apparatus by whose failure the leak is caused, while the stock form says nothing about that, assuming, evidently, that leakage from a sprinkler system that would cause damage would doubtless be confined to the sprinklers themselves. The stock form further eliminates loss for mishaps that might occur from what are ordinarily termed "Acts of God, or the Nation's enemies," while the mutual form makes no mention of loss under such conditions not being covered by the contract. Perhaps the more important feature of contrast in these two contracts is, that while the mutual form states that "This Company shall be liable for only such proportion of the sprinkler leakage loss as the amount insured on said property against fire by the policy above mentioned bears to the whole amount of fire insurance thereon;" reference, you note, is made here to the fact that is brought out in the first paragraph of the mutual form, namely — that this sprinkler leakage insurance is made a part of a regular fire policy. The stock form we are discussing, is a sprinkler leakage form, pure and simple, wholly independent of the fire insurance policies on the same property. Therefore, no reference to them would be needed.

Either of these forms are good and seemingly free from defects. They are surely clear in every intent and are desirable policies for an assured to have, especially at the low cost at which, today, insurance of this character can be obtained.

At times, sprinkler leakage policies give rise to very puzzling questions in connection with losses. The worst conundrum of this character that has ever been referred to me, and regarding which the correct ruling is still a matter of doubt, is the following: You will note that sprinkler leakage policies state that they insure against direct loss or damage sustained by the assured by water discharge or leakage from the automatic sprinkler system.

Under the above stipulation, the question was raised, as to what would be the condition where a leakage from the sprinklers caused a short circuiting of an electric system, and a resulting fire? Would the assured look for the recovery of his total damage from his sprinkler leakage, or his fire policies?

Standard Policy—Clauses and Forms
Fourth Paper

BY

WILLIAM B. MEDLICOTT

Forms of Extended Area

Forms to Cover in More than One Place.

What do we mean by this? The usual fire policy, after describing the property covered, defines the locality where it is insured, that is, it fixes its field of operation in some one place.

It would be not only very inconvenient, but in fact impossible, with moving properties to protect them against fire loss in their journeyings, by issuing a separate policy to cover in every place that they might be in. Forms are devised, therefore, to cover in any place where such moving properties might be. All marine insurance forms are of necessity of this nature. A marine policy derives its name from its being originally devised to insure properties in transit by water. Properties being carried by ships or boats from one place to another on the water. Insurance of this sort is one of the very oldest forms to come into use. The perils of the sea, both from shipwreck and fire, were recognized long before the danger of loss from fire to properties on the land was given much thought. As time has gone on, the broad covering quality essential to the marine policy has been found applicable to moving properties on land as well as sea, and in consequence all forms covering property in changing location have partaken of much that originally was confined to strictly marine or water born risks. The automobile policies now being written so freely are good illustrations of the way in which the marine form is now being used. The ordinary marine policy usually confines itself to property while in some particular vessel or vessels, it does not protect against loss from perils of the sea, at some one particular point, but anywhere that the journeyings of the containing vessel may reach. In the same way the fire policy designed to cover moving property, does not specify that its protection shall be limited to that property in some one particular place. Its purpose is to protect the property anywhere within certain more or less widely defined limits. Such policies in a general way are described as floaters.

Floaters.

The use of this title in defining a certain class of fire insurance policies is a very broad one. In fact, its meaning in England is quite different from that attaching to it in this country. There they speak of a "floater" as a policy that is devised to sort of fill in the shortages of other more specific insurance, that may be disclosed by destroyed values at the time of a loss. They use it more in the way that we speak of "excess" insurance. We, while we regard excess insurance as one kind of floater, still speak of it as excess and confine the use of the name "floater" to an insurance that travels with a movable property or properties that are in various somewhat indefinitely defined locations. We think of it as a sort of Guardian Angel, and when injury by fire occurs to any of the property under its care, it at once interposes itself and seeks to alleviate the loss. It is a kind of journeying physician, ever with the traveler and always at hand to restore him to health if possible.

There are many forms which insurance of this sort may take. There are those that are devised for some specific property and specified owner, of which the most common form is what is known as a "*Tourist Policy*". Then there are those that are designed to cover miscellaneous goods in the hands of transporting companies or individuals who hold the same in the capacity of "*Common Carriers.*" Both of these classes are floaters in the broad sense in which that term is used, though they raise very different questions in the treatment which should be accorded to each. Let us in considering forms applicable to insurance covering in extended areas, first confine ourselves to the forms used in connection with so-called tourist policies.

Tourist Policies.

A policy of this character, is, as its name implies, especially designed to accommodate those who are engaged in travelling and who naturally desire to carry with them property, usually in the form of clothing, and personal belongings, though at times the forms are extended so as to cover things that are not ordinarily found with belongings of this character. Some of the forms attaching to policies of this nature are extremely broad and protect against loss or damage from more than fire alone, in fact, they are practically marine policies in their make-up. A marine form for this purpose reads substantially as follows:

Marine Tourist Form.

"This policy witnesseth that..........is insured in the sum of $..........from..........to..........on baggage and/or personal effects being the property of the Assured or any member of his family or servant accompanying the Assured or his family.

"This policy attaches from the time the property insured is taken from the residence of the Assured and continues wherever said property may accompany the Assured or his family during the term of the policy, covering all the risks and perils of fire, lightning, navigation and transportation, including the risk of theft as described hereafter, while being transported by any railroad, express, transfer and/or transportation company and/or by any steam-ship, steam-boat or craft on the ocean or on inland waters, and to cover the risk of fire and lightning while in any hotel, dwelling, business building and/or other repository, excepting theatres and other places of public amusement.

"This policy covers while on board of any yacht against loss caused only by stranding, sinking, burning or collision of the yacht.

"It is understood that this policy covers against loss by theft while in the custody of any common carrier or other bailee (that is, the person to whom the goods are committed in trust) and is also to cover against loss by theft of entire trunks, valises or other shipping packages from rooms occupied by Assured, or when checked in any hotel or boarding house, provided that the local Police authorities are notified immediately upon discovery of loss, but this clause shall under no circumstances be construed to include pilferage, nor the loss by theft of articles in the custody of the Assured, only as herein mentioned.

"This policy does not cover or attach in the residence of the Assured nor on property specifically insured, nor in storage, nor on automobiles, or motorcycles and their appurtenances or equipment.

"This Company shall not be liable for loss of accounts, bills, currency, deeds, evidences of debt, money, notes or securities, under any circumstances nor for loss of jewelry or similar valuables by theft."

Following the above more important paragraphs there are a number of warranties frequently attached to a policy of this nature regarding breakage, risks of war, limitation of value, conditions that might arise when the property covered is in several places at the same time, disregard of particular average and provisions for cancellation. In this country, policies of this character are only limited usually, so far as the area in which they apply, by the limits of the United States and Canada and on steamers or sailing vessels between places in these two countries.

Cover More Than Fire Damage.

You will note that a form like this protects against other loss than that which may be caused either directly or indirectly by fire. Since a form of this nature is so comprehensive, it is usually desired in preference to one that simply safe-guards against a fire loss and its issuance is confined to such companies as are chartered to do a marine business. As we are considering forms applicable to fire policies only, and also since the majority of fire companies are not operating under charters sufficiently broad to enable them to assume all of these outside hazards, we will pass on to the consideration of such a form as is directly applicable to the ordinary fire policy. A form of this nature will read substantially as follows:

"$............on............(usually wearing apparel and personal effects) the property of the Assured and members of the family wherever they may go in the United States of America, Mexico or Canada, or while being transported by train, boat or conveyance of any kind.

"It is understood and agreed that this policy does not cover in any place where the Assured has specific insurance on the above described property.

"It is understood, if in case of loss and by reason of such loss, the Assured shall acquire a right of action against any individual firm or corporation, for damage to the property above described, he will sign and transfer such claim to this Company upon receiving payment for loss from this Company and subrogate this Company to all his rights and demands of every kind respecting the same and permit suit to be brought in his name, but at this Company's risk and expense.

"In case the property above described shall be in different places, this policy covers at each place that proportion of the whole amount of this policy, that the value of the property in each bears to the value of all.

"But it is at the same time declared and agreed that any property included in the terms of this policy shall at the time of any fire, be insured in any Marine Insurance Company, this policy shall not extend to cover the same, excepting only as far as relates to any excess of value beyond the amount of such Marine Insurance or Insurances, and shall not be liable for any loss unless the amount of such loss shall exceed the amount of such Marine Insurance or Insurances, which said excess only is to be under the protection of this policy, it being the true intent and meaning of this agreement that this Company shall not be declared liable for any loss, unless the amount of such loss shall exceed the amount of the Marine Insurance or Insurances, and then only for such excess."

You will note that under a policy of this kind, one may insure against fire loss, anything that the insurance company will accept and allow to be incorporated in the property description paragraph of the form. You will also note that such a form protects the property wherever it may be in the United States, Mexico and Canada, not only while it is in hotels or other buildings, but also while it is on railroad trains or steamboats, either standing or in transit.

You will also note that this form ceases to apply at any point where the assured has this same property specifically insured. For illustration, suppose that a party intending to travel, packs his trunk in readiness for his journey, takes out, from a certain date, a tourist floater, such as we are describing, and before his trunks have been taken from his dwelling, a fire occurs and damages these trunks and their contents. If, under these conditions the assured has a policy covering the contents of his dwelling, he must look to that for his indemnity. If, on the other hand, he has not such a policy, but does hold the tourist policy referred to, it could be claimed that the tourist policy covered under this form, even though the journey had not actually commenced.

Some forms still further define the liability in a stiuation of this sort, by stating that the policy attached from the time the property is taken from the residence of the assured and ceases to apply as soon as this property returns to the residence in question, thus eliminating the doubt that we have said might arise where there was no specific insurance on the tourist's home.

The Subrogation Feature.

The Subrogation Clause, forming a part of the form we are considering, is surely a reasonable provision, for it would be manifestly unfair either for the assured to collect damages both from the transporting company and the insurance company for injury to the same property, or to ask the insurance companies to stand a loss that was guaranteed against by the transporting company. Consequently, if the insurance company pays for the loss or damage to the property while in the hands of the transporting company, it is only reasonable that the right should be accorded it, of taking subrogation, or that is, of having granted to it, the same rights of collection from the transporting company that the assured, under his contract with the transporting company was in possession of.

An Average Provision Essential.

The clause providing that if the property covered is in several different places that the proportion of the whole amount of the insurance under the policy that is applicable to the particular location affected by the fire shall be regarded as the insurance at that particular point, is a simple application of the average clause.

Assume, in illustration of this, that a tourist had three trunks containing property of equal value and that incident to the circumstances of his journey, two of these trunks were at a hotel, while the third remained at a railroad station when a fire occurred that damaged the trunk stored therein. Under the provisions referred to, one-third of the policy is covered in the railroad station and is liable for the loss of the trunk therein stored.

The final paragraph of the form under discussion, raises the excess feature and you will recall that I have already said that excess insurance is of the nature of a floater, and as we purpose discussing excess insurance a little more fully later on, we will defer speaking in detail of this particular clause.

It is true that the features that we have been mentioning may be strictly defined as forms, and there are also several provisions that are distinctly of the nature of clauses. Since these so-called "clauses" such as the Subrogation Clause, the Average Clause, the Exemption of Specific Insurance Clause, have an essential and very direct bearing on the form as a whole, it seemed best to anticipate somewhat, and speak of them as we have done.

Not infrequently the underwriter is called upon to insure some specific piece of travelling property and the exercise of careful thought is necessary in determining whether insurance of this character is desirable or not. To illustrate this, let us assume that the subject of the insurance is a highly valued violin,

that a certain artist wishes to take with him to various summer hotels for concert purposes. Here is a very susceptible piece of property, and while it is an article that can usually be easily saved, and if it is really valued by the owner, undoubtedly would be the first thing he would try to save in the event of a fire occurring, yet the opportunities suggested for an excessive claim that could probably be maintained, are very great. The assured usually regards the risk attaching to an article of this kind as very slight and expects that the insurance can be written at just as low a rate as he obtained on his household furniture including a piano and other musical instruments in his home. In such a condition as we are describing, the owner may, quite likely, be living in a dwelling where the contents are rated at say seventy-five cents for 5 years. When he commences to travel, he and his violin may be in summer hotels of varying merits, rated all the way from 2 to 3½% per annum. It is difficult to get the average assured to see just why he should pay a higher rate the minute his violin leaves his home though very apparent to the underwriter. In considering a proposition of this kind, actual knowledge of the true value of the property involved is a very essential thing and while the form and the rate cannot reach it, the underwriter is certainly beholden to consider the character of the assured very closely and to feel confident that he really prefers the violin to the money which might be easily obtainable under such a policy as we are speaking of.

I have dwelt thus at length on this simple illustration, because it serves to show the hazards and opportunities that are presented to an unscrupulous property owner under a policy of this kind. How easy it is in a summer hotel, for instance, for a lamp to be tipped over and an alleged $500 violin ruined without at the same time, having the entire building burned up!

The Main Objection to Floating Insurance.

The main objection to floaters, is that the more extended the area of their operation, the greater the opportunity for loss and the greater the difficulty in determining equitably the actual amount of that loss, renders them a class of insurance that should bear very close scrutiny and that should call for the collection of a commensurate rate.

Common Carriers.

Another form and a more important one probably, attaching to policies covering extended areas is that of what is known as Common Carriers.

Just what do we mean by a "Common Carrier". I have been interested to look up the definition of the same and find that competent authorities describe it as follows: "A Common

Carrier" is a person who undertakes to carry goods from place to place for hire. He is a public servant and is bound to carry and is responsible for every injury occasioned to the goods by any means whatsoever, except only the act of God or his country's enemies." Consequently, when goods are destroyed by fire, the common carrier is responsible to the owner whether he has been guilty of neglect or not, and he is excused from liability only in the following cases, which usually are limitations fixed by law, as to his liability in his capacity as a common carrier.

First, where the transit of the goods is ended and the goods are no longer in his custody as a carrier. He is then a warehouseman and is subject therefore, to the liability of an ordinary Bailee, that is, the person to whom the goods are committed in trust.

Second, where he is exempt from liability by some law usually denominated the "Carrier's Act."

Third, whereby the terms of a special contract between himself and the bailor (that is, the person who delivers goods to another in trust), he is exempt from liability. For example, a railroad company entering into a contract to carry goods to a place beyond the limits of its own lines and situate upon the line of another company, does not cease to be liable when the goods are transferred to the other company. If, therefore, the goods are destroyed by fire, while being carried by the second company, the first company is responsible by virtue of the contract which is made, although the other company may also be liable to the owner for the loss.

The law usually relieves the common carrier of liability for certain specified properties of high value, such as jewelry, gold or silver coin, stamps, notes, securities, unless at the time of delivery of them to him, both the value and the nature of such articles shall have been declared and in accordance therewith, charges either paid or an engagement to pay the same accepted by the person who may receive the consignment. For such special articles the carrier may demand an advanced rate or charge which is to be guaranteed by a receipt of notice attached. Carriers who omit to affix such a notice, are precluded from the benefits so far as the right to the extra charge is concerned, but even in that case, are entitled to a declaration of the value and nature of the goods, but they are prohibited from attempting to limit their liability by public notice as to the articles not exempt by law. Special contracts, however, may be allowed.

The reason that we have spoken of these features of common carrier liability, is because it is under them that so frequently in claims under a fire policy insuring common carriers' liability, conditions arise wholly unlooked for by the party issuing the policy and it is desirable therefore that in the event of there

being some special allowance or restriction imposed by the contract or receipt issued by the common carrier in accepting goods, that the fire policy should either disclose or at least call attention to them. A good illustration of this has occurred in a couple of losses that have recently been up for consideration. Here is a form, reading for the A. & C. Railroad:

An Ordinary Railroad Carriers Liability Form.

"On merchandise and goods their own or for which the Insured may be liable or held by the Insured as Common Carriers or warehousemen or under any bill of lading, including all charges therein advanced or due to other lines or railroads, or steamboats carrying such merchandise or goods as they may have in their custody or for which, and to such extent and amounts as they are in any manner responsible, also all express pertaining thereto, and on all stock, materials and supplies all contained in and on frame building and structures and outside on wharf on premises known as piers No..............situate............. Permission is hereby given to have, store and keep and use, such goods, merchandise and articles as are incidental to the Transportation Companies and the business of railroads, steamboats and vessels and to have, keep and use camphene, chemical and coal oils and burning fluids. To use hoisting engines, and to work nights and for other insurance without notice until requested.

"This policy insures loss if any, payable to said A. & C. R. R. whether that Company's interest is direct or as lessee of some other corporation, it being understood that this structure is upon the property of one of the corporations whose property it holds through lease."

Then follows a Mechanics' Permit, Electric Light Permit, Lightning, Automatic Fire Alarm and Watchman's Clock Clauses.

The intent of this policy seems clearly to be to insure the said A. & C. Railroad in their capacity of common carriers and a loss having occurred on the premises in question, the sums required of the railroad on account of damaged merchandise were in turn paid to it by the insuring companies. Later it appeared that certain of the owners of goods and merchandise claimed to have been lost in the fire, brought suit against the A. & C. Railroad and all of the companies insuring it, on the ground that the policies were taken out by the railroad as well for the benefit of their consignors as for their own benefit, and the form that we have just quoted, insured the owners of the goods against loss, as well as the railroad, in its liability as common carriers.

A condition of this sort brings out the fact that everything must depend in the adjustment of such a claim, as to how far, under their contract as common carriers, the railroad was liable to their consignors. How this suit will finally be disposed of, is a matter that is still uncertain. There would seem to be nothing in the form we quoted which could render a broader interpretation than that in the second line, where it states, "as Common Carriers or Warehousemen" and again further down, "to such extent and amounts as they are in any manner responsible." Everything you will see, depends upon the limit of this responsibility, and that can only be determined by know-

ing exactly what is the nature of the contract that the receipt given by the railroad to its consignors, discloses.

It would seem from a condition such as the one we have just described, as if some uniform law was necessary defining what is meant by common carrier liability and that if something outside of the intent of such defined liability was contemplated, that it should also be required to have it fully stated.

An effort sometimes to avoid complications of this sort, is made by the insertion of a clause in addition to the description of the rolling stock and movable property of a railway. An illustration is before me reading:

A Conflicting Carrier Form.

"All articles, materials or apparatus, appurtenances to operating this railway and for maintaining, repairing and extending the same, their own or held by them belonging to others for which they may be liable and on freight thereon or held by them belonging to others for which they may be liable, contained in any of the buildings of the said Railroad or in any of its cars at any point upon the line."

Among the many restrictive clauses attached to the foot of this form, is one reading:

"This policy does not cover the Assured's liability as Common Carrier."

The policy in question is a straight fire policy, and just how to reconcile the two paragraphs referred to, is something of a puzzle. Also, it is only fair to say, the final arbitration of a claim that has arisen thereunder, is yet uncertain. In this instance a certain party delivered certain freight to the road for transportation and took an ordinary receipt therefore. Apparently the first paragraph reading, "on freight held by them belonging to others for which they may be held liable," would appear to make the road liable to the consignor, on the other hand, the companies, by the second paragraph, would appear to be freed from liability if this particular freight in question was accepted by the road in its capacity of common carrier. This illustration again emphasizes the point we have already spoken of, namely that in drafting forms of this sort, the position of the transporting company can only be clearly defined when the nature of the contract into which it has entered with its consignor is fully disclosed.

Some of the difficulties that arise in the insurance of common carriers, also appear when we insure directly for its owner, property while in transit.

An interesting and still unsettled claim has arisen under a form of this nature reading:

A Broad Form for Owners Liability in Transit.

"On merchandise, principally woolen goods, their own or held in trust or on commission, and for which they may be held liable, in transit between..........or any other place in the United States to Boston, Mass.,

and vice versa, and at either end of the route until delivery, subject to the following conditions of average annexed:

Other Insurance Permitted
Average Clause

"It is understood and agreed that in case of loss under this policy this Company shall be liable only for such proportion of the whole loss as the amount of this insurance bears to the cash value of the whole property herein described, at the time of the fire. — Lightning Clause."

The claim is made for damage caused by a fire resulting from sulphuric acid being carried in the same car with the property (in this case machinery) and one or more of the acid carboys becoming broken. The damage was done on some one of the four days occupied in transit and at an unknown point in Pennsylvania, New Jersey, New York, Connecticut or Massachusetts.

The following questions arise:

1. Under the form, the policy being written in Massachusetts, is the policy liable for a loss in any other state?

Answer. Yes.

2. Is the issuing of such a policy legal since it covers property that may be outside the state in which the policy is written?

Answer. Yes, the policy being a floater and covering property that at times is in the state where the policy was written, also the assured in this instance were a Massachusetts corporation.

3. Can machinery be classed as merchandise and, therefore, is a claim valid on machinery insured as merchandise?

Answer. Yes. Merchandise, in its broad interpretation, may mean anything movable.

4. Does the fact that the merchandise insured is described as "principally woolens," free the insuring company from liability in this case, the loss being on machinery?

Answer. No. "Principally" does not limit the nature of the merchandise to woolens.

5. Does the fact that time and place of the fire are both indeterminate preclude the making of a valid claim?

Answer. No. With all floating policies these features are necessarily more often than not impossible of exact determination and a floating form of policy in its intent clearly admits this.

6. Does the fact that the fire was caused by the transporting railroad carrying extra hazardous articles in the same car with the insured "merchandise" void the insurance policy and does it give the said insuring company the right to demand subrogation?

The answer to this must be that under the policy the insuring company is holden to pay the loss since there are no restrictions in the form as to the method or association of carriage.

The right to subrogate the railroad by the insurance company in this case when they have paid the loss under their policy is clear. Whether they can collect from the railroad or not will all depend on the state laws governing the carriage of acids and the nature of the contract defined on the receipt given the assured by the railroad on the latter receiving the "merchandise."

We have made use of this claim and the questions that arose under it to bring to your attention some of the conditions that arise in floating policies of this somewhat indefinite nature.

Thus far, we have spoken of the difficulties that confront the framer of a common carrier form and doubtless you are anxious to know how a form should be drafted to satisfactorily safeguard such difficulties as we have referred to. Some of these are written without and some disclaiming liability. Good forms illustrating this are:

Common Carrier Liability Form When Liability is not Disclaimed.

Boston & Albany Railroad Co.

"$............On their lebal liability in or for all merchandise and/or baggage and/or freight held in their custody as common carriers, warehousemen, wharfingers, forwarders, or freighters; also upon their interest in all advances or other charges due or to become due upon all merchandise and/or baggage and/or freight while contained in their wharf and shed adjacent to elevator situated, etc.

"It being mutually understood and agreed that if claim is made against the assured hereunder for merchandise and/or baggage and/ freight held by them as above provided, the insurers shall have the option of either admitting such claim for payment or of resisting it in court; the legal expenses incurred in such resistance to be borne by the insurance companies interested, in the proportion that the total amount of this insurance shall bear to the total amount of such claim or claims."

Note the optional feature of the second paragraph. This is inserted because so frequently a common carrier's liability fire policy is considered as covering actual property damage by fire. True it is that the damage causing the claim under such a policy is the result of a fire loss; but the subject of this form of insurance is not the property in the custody of the carrier, but what under his contract as a carrier he is obliged to make good to the consignor of such property to him.

This feature is often overlooked and it is just such oversight that results in a claim being made like the one we have already spoken of in connection with the A. & C. railroad.

By the use of the words in the carriers' form we are considering, "the insurers shall have the option of either admitting such claim for payment or of resisting it in Court," the insuring company admits that it can, if it so elect, (goverened wholly by circumstances) pay a direct fire loss for goods burned, even should such loss exceed the carrier's liability for them.

This is a large hearted form. Instead of saying definitely that the insurer will pay for a certain definite thing and nothing else, it gives him the option of doing something more. It removes his best weapon of defense; it throws aside the barrier that should safeguard him. It gives the claimant the right to ask for more than he paid for. Not a wholly desirable form to use. Optional features are always likely to lead to disagreements and create prejudice.

To prevent such conditions, there is in use a form for

Common Carrier Liability when Liability is Disclaimed.

Such a form reads:

Boston & Norfolk Steamship Co.

"$............On their legal liability in or for all merchandise held in their custody as common carriers, warehouse men, wharfingers, forwarders or freighters; while contained in freight shed, situate, etc.

"The purpose of this insurance is to indemnify the insured for their legal liability, if any, to the amount they are obliged to pay on such merchandise by reason of loss or damage by fire, and it is understood that liability for such loss or damage by fire is and will be disclaimed in bills of lading, shipping receipts and other similar documents.

"It is also understood and agreed that all claims against the insured (provided the claim or claims are not in excess of the amount insured) shall be resisted under the direction and control of this Company, the cost of such resistance (whether conducted by the insured or by this Company) to be paid by this Company in the proportion that the amount of this policy bears to the total amount of such claim or claims.

"In the event of loss hereunder this Company shall be subrogated to all claims upon owners of merchandise to the extent of payment made to the said steamship company."

Under this form the insuring company can only pay for carriers' liability, — no direct merchandise loss is admissible. It fixes the limit of liberality for the insurance company and the limit of avarice for the claimant. It is a wise provision and it saves dispute.

Under the form that does not disclaim further liability the right of subrogation is not, in fact it could not be, asked. Under the form that does disclaim further liability, such right of subrogation may be asked and you will note that it is incorporated in the form.

An especial safeguard in both of these forms is the use of the word "Legal" in the first line. This confines the liability assumed under the policy to just what the carrier is beholden to his consignors for as specified by his receipt or contract with the latter, and should prevent the said consignor from looking to the carrier's policy as a source from which to collect further loss that might have been sustained.

Excess Floater Insurance.

The last form of floater of which I want to speak to you at this time is that used with excess floater insurance.

The design of insurance of this form is to make good the losses that may come to an insured through a shortage of specific insurance at some location where he may have insured property. Such excess insurance may be restricted to property in one place or it may, and more frequently does, cover properties moving about in a more or less extended area. As it is usually applied to insurance on floating properties, it is well to discuss it here.

Excess insurance is that taken upon any subject where it is expressly stipulated that the amount specified thereon shall not be liable for any loss until all specific insurance upon the subject property shall have been exhausted. If the specific insurance is adequate to pay the whole loss, then the excess insurance does not apply.

Policies of this sort whether floating or not are desirable for the assured. Their especial field of value, though, is under the floating form. Where goods are liable to be in any one of a number of locations and where specific insurance is carried on them in each one of these locations, the time may arise when, owing to a congestion of these goods at some particular place, the specific insurance in force there is wholly inadequate to cover. Should a loss happen at such a time, an excess floater would come in and further indemnify the insured.

The form for such a policy could read:

An Excess Floater Form.

"On merchandise, chiefly............own, or held by............in trust or on commission, or on joint account with others, or sold but not removed, and not under the protection of a Marine Policy, while contained in all or any of the brick or stone storage warehouses and while in transit in or on any of the streets, depots, yards or wharves in the City of...... ..... and in any shop or vessel in the port of said city, subject to the following conditions: —

Reduced Rate Average Clause.

"In consideration of the reduced rate at which this policy is written, it is expressly stipulated and made a condition of this contract that this company shall be liable for no greater proportion of any loss than the amount hereby insured bears to the actual cash value of the property described herein at the time when such loss shall happen, nor for more than the proportion which this policy bears to the total insurance thereon.

"If this policy be divided into two or more items, the foregoing conditions shall apply to each item separately; and if two or more buildings or their contents be included in a single item, the application of the provision as to special inventory or appraisement shall be limited to each building and its contents.

Exception Clause.

"It is understood and agreed that goods on which the insured have a specific insurance are not covered by this policy except so far only as relates to any excess of value above such specific insurance and that this policy shall be liable only for its proportion of any loss, on such property, which exceeds such specific insurance."

Then follow paragraphs excluding certain extra hazardous properties and locations. You will note that the exception clause defines clearly the excess feature we have commented on.

Standard Policy—Clauses and Forms
Fifth Paper

BY

WILLIAM B. MEDLICOTT

Fire Insurance Clauses

Clauses of Permission.

Any form of standard policy sets forth certain conditions under which the policy contract will be voided. Some of these as already explained are conditions that could not rightfully be waived, while there are others which, if the insurer sees fit to do so, may for sufficient reason be set aside, or that is, waived.

Authority to waive these standard provisions is, of necessity, vested in all the local or commissioned agents of the fire insurance companies, unless restrictions have been placed upon their authority and are inserted in either the application for insurance or in the policy itself, or in some other manner, have been made known to the insured. If this condition is not made clearly apparent it is necessarily assumed that the commissioned agents have the necessary power to waive conditions and forfeitures, and to stop the company without further written permission to do so. This conclusion is mainly based on the extent of the actual authority vested in such agents' commission of authority ordinarily empowering them to perform such acts as the accepting or the rejecting of proposals for insurance, the countersigning, delivering, renewing or cancelling of policies, the granting of necessary permits, and in some cases, even fixing of the premium rate.

Waiver and Estoppel.

In order that these rights of waiver and estoppel are clearly understood, let us seek to define them. Waiver is the voluntary relinquishment or giving up of some known right. Estoppel is the bar which is vested in equity in the interests of fair dealing, to prevent one party from enforcing to the disadvantage of the other, certain rights which he appears to possess under the letter of the contract. When by its declarations, agreement or conduct, it has induced the other party to believe that such

rights have been relinquished, then an estoppel raises what we have termed, the bar, to prevent the rights of the party who would otherwise suffer from being encroached upon. Waiver being the voluntary abandonment of a right, estoppel can only include such cases where an abandonment is inferred or imposed by the Court from the nature of the conduct of the party who would otherwise be entitled to the right. Waiver rests upon knowledge of the right and an intention to abandon it by, in the case of an insurance policy, the party issuing the contract, that is the insurer. Estoppel rests upon misleading conduct by one party to the prejudice of the other, and is forced upon the would-be wrongdoer by the Court in order to prevent fraud, either actual or constructed.

In studying "Clauses of Permission" it is more important for us to consider the intent and the rights granted by waivers rather than to give attention to what might constitute an estoppel.

Silence by Insurer Not Necessarily a Voidance of His Rights.

The mere fact of nothing being said by a company after knowledge of a forfeiture of the policy by the assured, or the commission of some act that would appear to create a voidance of the policy, will not, in general, operate as a waiver. That is, since the company has not contracted to search out the insured under its policies and advise them as to the legal effect of the policy provisions, the fact that they have not advised the insured of the way in which they regard the consequences of his act, would not constitute a waiver of their rights resulting from a voidance of the policy by the violation of some one or more of its provisions by the assured. We speak of this because, at times, the claim is made, where a loss occurs under a policy owing to the introduction of some extra hazardous material or process into the property covered, that the company or its representative never told the assured that they must not create this condition of extra hazard, and that since nothing was said about it, the assured inferred that he had a perfect right to do as he pleased. In a case like this, the fact that the company had given no advice does not constitute a waiver of the rights and safeguards that were granted it (the insuring company) under the provisions of the policy.

Does a Voidance Permanently Destroy the Contract?

It is interesting in this connection to consider whether the temporary voidance of a policy, owing to the insured party having committed some act expressly prohibited in the policy contract, kills the policy. This is a question that has been the

subject of considerable dispute, it being maintained in some cases that if, for example, by the introduction of some extra hazardous and prohibited material or process into a property, the policy conditions were violated and the contract voided, whether, if this hazardous material or process was later on removed from the building, the policy automatically again became operative, that is, was revived and made a live contract. I do not find that there has ever been any definite ruling on this point that would govern all cases. Apparently, if the insurers recognized the policy after such an act of voidance, as being a live contract, such recognition would make it so. In any event it seems to have been regarded as a very inadequate defense for a company to set up that the policy was void because there was on the premises, for illustration, some prohibited article stored prior to a fire that created a claim, even though the origin of the fire may have been wholly foreign to the existence of the prohibited article. Evidence of knowledge on the part of the insuring company of the presence of these prohibitive conditions is the feature that must mainly determine the final ruling. If, knowing the increase of hazard, they allowed the policy to continue and took no steps to cancel the contract, it is only fair to assume that such contract is still in force.

We have spoken in this general manner of waivers, in order to direct the view that you will be called on to take of them in connection with clauses that permit the setting aside of any of the standard policy provisions.

Certain Policy Provisions Cannot be Waived.

You have already been told that there are certain clauses that cannot be waived. Parties to a contract of insurance within a certain state cannot waive the provisions of a general statute of that state unless the statute authorizes their doing so. For example, the rule requiring an insurable interest as one of the conditions of the fire insurance contract, whether it is prescribed by a special statute or not, being adopted out of regard for the welfare of the state may not be waived by the parties to the insurance contract. A corporation cannot do an act that is beyond the corporate powers vested in it by its charter and every one dealing with the corporation is assumed to be aware of the nature and extent of such power. If a fire insurance company organized in Massachusetts to do a fire business, should attempt to make a contract in life or ocean marine insurance, the contract would be void because the company was attempting to do something that implied the existence of rights and powers not vested in it by its Massachusetts charter. There are other features of the fire insurance policy which cannot be waived, but our attention must be directed more particularly to those that can, since it is to this latter class of conditions that clauses of permission especially apply.

We have called attention to these provisions that cannot be set aside by waiver in order to cause you to think of the rights that may, or may not, exist when you are considering the setting aside of any of the policy conditions, rather than to give definite instruction.

What Policy Provisions Can Be Waived.

What can be waived? Any condition or provision of the policy that is inserted for the benefit of the insuring company, even stipulations which appear to provide that there shall be no waiver, or that no waiver shall be made except in a special manner, as by writing, or that certain classes of persons shall be deemed to have no authority to waive, may be waived by the insurers through such representatives of theirs as have the requisite authority. This may seem strange and somewhat one sided, but it is rightfully assumed and granted that the party who has the right to make a contract should also have the power to alter it to any extent they may wish unless restricted by statute, provided the insured party approves and accepts.

Since under these conditions the rights that are waived are all of them set aside for the benefit of the insured party, objection on his part is a very remote condition.

The fact that by the attachment of permissible clauses rights that would otherwise exist for the benefit of one party or the other can be waived, carries with it the importance of the insured party knowing exactly what there is in these waivers of certain features of the policy contract. It is not only essential for the safeguarding of the insured that he should see to it that the standard form of policy used is the correct and duly authorized one, and that the description of his property is clear and unmistakable, but he should also scrutinize most closely the clauses that may be attached, especially those constituting waivers, for while the majority of such clauses tend to remove rights more directly beneficial to the insurer, there are those that often are used that may take away or materially reduce his own rights.

What provisions of the standard policy contract, then, do clauses of permission especially affect? You will agree, I am sure, that they apply particularly to what are termed the voidance clauses, that is those conditions under which the standard contract states "That this entire policy shall be void if," and then follow a number of defined conditions.

The New York or Connecticut and the Massachusetts standard policies, in the main, agree as to just what these voidances are, and the comments that we purpose making on them are applicable to either form of policy, excepting in the one or two instances to which we purpose calling attention.

Witholding of Material Facts.

You will note that the Massachusetts standard form states that this policy shall be void "If any material fact or circumstance, stated in writing, has not been fairly represented by the assured." It hardly seems possible that any underwriter would desire to waive any of the conditions of this provision. Doubtless, an underwriter would not, but unfortunately many of the assured and some brokers, have sought to set aside the safeguard imposed on the ground that unintentionally and in a most innocent manner, an ignorant assured might misrepresent in taking out his insurance and thereby void his claim in the event of a loss occurring. It is very interesting to note in this connection that it is not the ignorant assured that raises this issue, or that seems to desire to have the effect of their ignorance diverted from them in the manner suggested, but it is always a suggestion of those, who not only are far from ignorant, but who would greatly resent any imputation that they were. It is hard to understand how the public statutes of any state could seek to waive this provision, since by so doing they virtually compound a possible felony and are legalizing what would often prove a fraud, but it is a fact that one of the southern states has especially provided that under certain conditions, the companies must waive their rights to claim forfeitures on account of misrepresentation of facts at the time the insurance was taken out.

Concealment or Misrepresentation.

The New York form of policy is very much more explicit in its reference to this feature and states that the entire policy shall be void "If the insured has concealed or misrepresented in writing *or otherwise*, any material fact or circumstance concerning this insurance or the subject thereof, or if the interest of the insured in the property be not truly stated therein. Or, in case of any fraud or false swearing by the insured touching any matter relating to this insurance or the subject thereof, whether before or after a loss." It certainly would seem as if this description as to what will constitute a voidance, was so clear as to admit of no possible doubt. So much latitude, though, has been given by the Courts in their interpretation of this provision that, unfortunately, it has to a large extent, become a dead letter.

There can be no question but what any clause or rider attached to a policy that would in any degree limit the conditions of this provision, would be most unwise and wholly uncalled for, and would be rigidly objected to.

Other Instances.

The next of the voidance clauses is "or, if the assured now has or shall hereafter make any other insurance on the said property without the assent in writing or in print, of the company." The voidance of this provision, which in its intent is a perfectly proper and wise one, but which, however, may be rightfully waived, is accomplished by the simple insertion of the words under the description of the property "other insurance permitted." The reason for the insertion of this phrase in the standard policy is that is establishes a check to the over insurance of the property, and it, doubtless, was inserted by law makers who realized the tendency of the average jury to be over liberal in the estimate of the amount and value of properties. The presence of this clause calls attention to this condition, and if the company feels that the amount of its own policy is sufficient with respect to the value of the property, it reserves to it the right to refuse to attach the other "insurance permitted" clause, which would grant practically an unlimited amount. Doubtless, too, this provision to a certain extent reduces the temptation to bring about an opportune fire that might present itself to unscrupulous insureds.

Removal of Insured Property.

The policy will be void "If without consent of the company, the property insured shall be removed, except that if such removal shall be necessary for the preservation of the property from fire, this policy shall be valid without such assent for five days thereafter." Since the average insurance policy insures a certain party against loss or damage to a certain specified thing in a certain defined place, removal of the insured property would virtually call for the issuing of an entirely new contract, or the reformation of the policy by endorsement permitting the removal. If any waiver of this feature of the policy is granted, it is usually in the nature of a floating form which contemplates insuring the property in any location within certain more or less widely defined limits, such conditions as we considered under tourists' and carriers' policies.

An Increase of Risk.

Or, if without consent of the company the situation or circumstances affecting the risk shall by or with the knowledge, advice, agency or consent of the insured, be so altered as to cause an increase of such risks. The New York form sums up the situation by also inserting the words, "Or, if the hazard be increased by any means within the control or knowledge of the insured," but the whole object of either the Massachusetts or the New York provision is to prevent changes being

created by the insured in his property that may constitute an increase of hazard, without the insuring company being advised thereof and given opportunity to withdraw. There are a number of clauses of permission designed to meet the conditions of this policy provision, such as permission to effect other than ordinary alterations or repairs, builder's risk permits, mechanic's permits, and in fact, the number of special provisions for conditions out of the ordinary that may be allowed by clauses of permission, designed to offset this especial safeguarding feature of the policy, are many and varied.

Sold or Assigned.

Passing on in the list of conditions that void the policy, we find the Massachusetts form states that the policy shall be void, "If the property covered shall be sold or the policy assigned." It hardly seems necessary to comment on this provision when we remember that it is people, not things, that we insure, and if a certain property against the loss of which an insurance company has agreed to indemnify the insured party, ceases to belong to that party, the contract must at once become invalid and the only way to recognize that the insurance taken out shall follow the property will be by the attachment of an endorsement to the policy admitting of change in ownership. A clause granting this privilege is, perhaps, more properly one of title than of permission, though it is true that permission is granted by the endorsement for a change in the party protected thereby.

The Alienation Clause.

The New York policy is even more explicit and defines that the policy shall be void unless the interest of the insured is that of "sole and unconditional ownership." Also the New York policy embodies what is termed the alienation clause, which states that the policy shall be void "If any change other than by the death of an insured takes place in the interest, title or possession of the subject of insurance (except change of occupants without increase of hazard) whether by legal process, or judgment, or by voluntary act of the insured, or otherwise." The provision embraced in this clause is of the highest importance to the insuring company, but at the same time it furnishes a frequent cause of misunderstanding to an ignorant or careless assured. The insurance companies certainly have the right to know who they are contracting with, and it would be wholly wrong if any new party could be introduced in the contract without their consent. Nor, you will note, under the alienation clause can the insured alter the risk.

The Massachusetts standard policy being much less explicit regarding this feature, does not require, as a rule, any clause or provision bearing upon it, other than that which may form a part of the ordinary endorsement relative to change in ownership or occupancy.

The same restrictions apply to the assignment of the policy, and such assignments are, as you know, effected by an endorsement that must be assented to by the insuring company in order to continue the policy contract in force. This is another outcome of the personal indemnity feature of the insurance contract, and involves the universal principle that no new party can pose as an assured under an insurance policy without the consent of the insurer.

Vacancy and Non Occupancy.

The next voidance condition is that of vacancy, the standard form stating that the policy will be void "If the premises hereby insured shall become vacant by the removal of the owner or occupant, and shall remain vacant for more than thirty days after such assent." The New York form is a little more explicit in this, using the words "vacant or unoccupied" instead of simply the word "vacant." Furthermore, the term limit is reduced to ten days under the New York standard form. The reason for the addition of this word "unoccupied" is to give the restriction a broader effect in order to more thoroughly safeguard the insuring company. Technicalities in interpretation have so crept into the decisions rendered on insurance contracts that it has even been held that a building was not vacant so long as there was any air in it. We may say that this is absurd, but at the same time, it is a fact, and I have before me a list of upwards of twenty decisions that practically sustain that interpretation. Why unoccupancy should not call for an equal application of the saving grace of common sense in its interpretation, I cannot say, but it does not seem to have been subject to quite the same amount of foolishness as the interpretation of the word "vacant." The reason we speak of this condition is because so-called vacancy clauses, are ones of great importance and distinctly come under the same class that we are now considering, namely, clauses of permission. In order to properly draft and apply these clauses it must be essential for us to know what constitutes vacancy or unoccupancy. In the case of a dwelling, it would meet all the requirements of the policy provision if someone is habitually living and sleeping there, even though he was not constantly on the premises. On the other hand, it has been held and sustained, that to constitute an occupied dwelling house it was not essential that it be the sleeping place of some party, and that presence in the dwelling of anyone at more or less irregular intervals

and for even very brief periods of time, so long as they were present at periods within the term of limitation, would constitute an occupancy that would render the vacancy permit unnecessary. You will note that in the Massachusetts form the mention of vacancy is followed by the words "By the removal of the owner or occupant," and the insertion of this word "removal" seems to still further complicate the situation for in a neighboring state where the standard policy has a clause almost precisely like that in the Massachusetts form, the occupant of a house on account of the state of her health left her home unoccupied for a period of three months, taking with her only her clothing. She left with the understanding that someone was to visit the premises in the daytime at least twice a week. A fire occurred and the admission of the claim being the subject of controversy the Court held that there is a difference in meaning between "absence" and "removal" and left it to the jury to say whether the house was "vacant by removal."

With these somewhat conflicting opinions as to just what the vacancy clauses in the standard policies do really mean, it is somewhat difficult to determine just how a clause should be worded that will permit further vacancy or unoccupancy than that allowed by the policy, and at the same time, properly safeguard the interests of the insuring company. The tendency seems to be growing for the insured to place himself on the safe side by the adoption of the so-called unlimited vacancy permit. There can be no question but what permission of this kind is allowable if the company sees fit to grant it, but it often results in the occurrence of losses that are a great surprise to the company that finds itself paying a claim on what may have been for some time past, a practically abandoned property.

Operating Over Time.

Coupled with this provision of voidance in the Massachusetts policy is the statement that if the subject of the insurance "Be a manufacturing establishment running in whole or in part extra time, except that such establishment may run in whole or in part extra hours, not later than nine o'clock P. M., or if such establishments shall cease operation for more than thirty days without permission in writing endorsed hereon." Clauses granting permission for both the over time and the cease operation feature, are perfectly admissible if the company elect to grant them, and the clauses that are ordinarily in use to meet this need are both regular and generally acceptable. It is questioned, sometimes, as to whether there is any increase in hazard or not, when a manufacturing establishment is running nights, or when it is entirely shut down for a more or less extended period. Experience has shown that hazard does increase, owing to various physical causes, such as over-heated bearings,

the presence of fewer operatives and the consequent delay in the detection of a fire, and in the cease operations case, the possible introduction of moral hazard and the less close supervision that a property of this character naturally obtains. This calls for the attachment to the clause of a guarantee as to care and supervision — a guarantee, which though necessary, often proves ineffectual.

Attempt to Defraud.

It is somewhat surprising that in the arrangement of the voidance conditions in the Massachusetts policy, there is interjected between the permit to cease operations and the prohibition as to the keeping of certain extra hazardous articles, that there should be the proviso stating that the policy should be void "If the insured shall make any attempt to defraud the company, either before or after the loss." It would seem as if that proviso should have been made at the outset, or if brought in, in connection with any of the other voidances, that it should have accompanied the first of the mentioned voidances, that is, those of misrepresentation. The framing of a clause to exempt the assured from the voidance of his policy if he has been guilty of fraud in connection therewith, is something that we, fortunately, in this part of the country do not have to consider, but the way that insurance legislation has been going in some of our western and southern states, it is not unlikely that fraud might, when perpetrated in connection with a fire insurance policy, be elevated from the ranks of crime to those of virtue.

Dangerous Materials.

Probably the most important of all of the clauses, and the ones that are called the most frequently into use, are those that are drafted to meet the last of the requirements of this portion of the Massachusetts policy. Those that state that the policy shall be void if gun powder or certain other hazardous articles mentioned are kept in any manner deviating from that allowed or prescribed by law, or that if certain volatile products grouped usually under the general name of "gasoline," shall be kept on the premises insured.

The enormous increase in the use of the so-called volatile products, has necessitated the almost constant attachment of clauses permitting some one or the other of them to be kept and used under constantly varying conditions. The New York form of policy, in some ways, is more satisfactory in dealing with this question than is that of Massachusetts, for it does not recognize the fact as averting a voidance, that usuage or custom of trade in connection with the business carried on in insured premises will waive the provision of the policy, which states

that such policy shall be void if these hazardous materials are kept. This renders it seemingly more necessary to have the clause of permission that grants the keeping or using of these so-called gasoline products, much more clearly defined under the New York policy than under that of Massachusetts, though I do not find that there is any material difference in the phraseology of the forms currently used under each of these policies.

The increasing use of automobiles has introduced another feature of this gasolene hazard, and one that is nowadays ever with us. This has resulted in the combining in one clause of the permission to keep, under certain conditions, gasoline products and to permit also, the presence of the automobile in connection with which they are used. This gasoline feature raises the somewhat interesting question as to whether, in the written description of a property, the mention of the presence of these extra hazardous materials will, by itself, waive the policy provision prohibiting them, or whether it is not necessary to have a distinct clause calling attention to the presence of these dangerous substances and prescribing the conditions under which they may be kept in the insured premises. Sometimes the courts have held that wherever these prohibited articles might naturally or usually, belong to a stock of goods or other subject matter insured, that it is not necessary to further grant permit for their use, but such decisions are by no means absolute or unexceptional, and the only truly safe course to pursue is to attach the regular clause of permission that will meet the special condition of the case.

Damage by Lightning.

No mention is made in the Massachusetts form as to the attitude of the standard policy with respect to loss by lightning, leaving it, therefore, to be distinctly assumed that fire resulting from lightning is covered by the policy. This would exclude the damage that might be caused by lightning, other than that which might come from a resulting fire. The New York form of policy places this question beyond doubt and states that "liability for direct damage by lightning may be assumed by specific agreement hereon." It is this proviso that has given rise to the use of the so-called lightning clause, which is not, as so many people seem to think, necessary to enable them to collect for the fire damage that may result from a stroke of lightning, but its object is to make the policy also cover the wreckage or water damage, that may result from a lightning stroke in cases where a fire does not ensue.

Special Voidance Conditions.

There are certain special conditions brought into the New York policy that, while their recognition may call for the use of permissive clauses, are still ones that can, perhaps, be more properly considered under the topic of "clauses to meet special conditions," than for us to dwell on them here. I refer to those exemptions from liability for loss that may be caused by invasion, insurrection, riot, civil war, military or usurped power, neglect, explosion, fallen buildings, and in some of our states, earthquake. Permissive clauses to recognize hazards resulting from such sources are, in the case of some of these causes, at least admissible and will be the subject for consideration later on.

Leased Land.

Another of the special conditions that the New York policy recognizes as constituting voidance, which Massachusetts overlooks although it is one of the points that the careful underwriter always considers, is that of the leased land feature in cases where the subject of insurance stands upon land held in that manner. The New York policy distinctly states that the policy will be void "If the subject of the insurance be a building on ground not owned by the insured." Massachusetts, doubtless, regards the withholding of information of this sort as being one of the material facts that should be presented at the time the insurance was applied for, but it is a good plan to have attention especially called to it in the manner that the New York form of policy does. The clause safeguarding the assured in the event of a condition of this sort, while it is a permissive clause, is usually incorporated directly with the form of property description, and states after defining the property, that it is situated on leased land, located so and so.

Standard Clause Essential to Safety.

So much for the conditions that arise under the two most widely used forms of standard policy calling for the attachment of permissive clauses. As to the phraseology of such clauses, it seems to me, those that are prescribed by the National Board give us as desirable standards to work from as any, and uniformity in this respect is greatly to be desired. Remember that clauses are only needed where the waiving of some of the provisions of the standard policy are required, and remember what we said in an earlier lecture, that since the standard policy was an instrument devised by the very best of underwriting and legal talent, that it is unwise to attempt to amend it unless conditions absolutely require it, and then only within carefully defined limits. Clauses are in every way fully as important as forms, and the same care in drawing them and in seeing to

it that they are so worded as to do away with every possible doubt as to their real meaning, should be followed as in the describing of properties, or locations, or kind of liability covered.

Illustrations of clauses to meet the conditions we have been speaking of, are the following:

Removal Permit.

"Permission is hereby given during the period of thirty days from date hereof to remove the property insured under this policy from 44 South Main Street to brick building, No. 815 Wabash Avenue, Chicago.

"It is understood and agreed that during such removal this policy shall attach in both locations in proportion as the value of the property insured in each bears to such value in both localities, that from and after the expiration of said thirty days and prior thereto, if the removal shall have been completed, this policy shall attach in the new location only, and the effect of the average clause be discontinued, and that additional premium pro rata of increase in rate, if any, in the new location shall be paid within thirty days from this date."

Mechanic's Permit.

a Builder's Risk.

"$............ Builder's risk on the .... story .... building, with .... roof in course of construction, including material on ground immediately adjacent thereto, situated............

"Doors and windows to be closed and locked every night, and on Sundays and holidays, and shavings to be thoroughly cleaned out at least once a week. Smoking and fire prohibited in or around said building except fire in plumber's or tinner's pots. Such pots to be taken out of building every night."

(Note. — This may be used for either owner or builder.)

"When policy is issued to owner of building under construction this form fully protects him, but when policy is issued to the contractor or builder, let the policy be drawn in favor of either (or both) by name, and add always 'To cover his (or their) interest.' If the owner makes partial payments as building progresses, then the policy should be issued in the name of both owner and builder to prevent legal complications and secure prompt payment of loss."

b Ordinary Mechanics' Permit.

"In consideration of $............ additional premium paid therefor, and the warranty by the insured that no paint or similar substance shall be removed by burning in or upon the premises insured (or containing the property insured) without the consent of this company indorsed on this policy, permission is hereby given for mechanics to work in and about said premises for .... months from date, to make alterations, additions or repairs, and this policy (so far as it applies on building) shall also cover all materials and supplies therefor, therein or adjacent, and said alterations or additions when completed."

(Note. — This also covers building materials and supplies even though not yet a part of the building.)

c Special Mechanics' Permit.

"Builders' risk for two months on the two-story frame dwelling house, in course of erection, situate .... No fire to be allowed in said building except for heating glue in the kitchen fireplace. Doors and windows to be closed and locked at night, and shavings to be thoroughly cleaned out once a week."

(NOTE. — This form may be used with slight modification to cover additions or alterations to an already existing building; to vary the term of permission or to include a charge for such permission.)

d DEMOLITION PERMIT.

"In consideration of $........... additional premium, this company under this policy shall, in case of fire, be liable also for the loss or damage occasioned by the enforcement of any state law or city ordinance which necessitates, in rebuilding, the demolition of any portion of the insured building not damaged by fire, but not beyond the actual value, prior to the fire, of the property subject to such demolition and not for any expense of greater cost of reconstruction; provided that in no event shall this company be liable under this policy beyond the sum for which it is issued, and provided, further, that this company shall be liable only for such proportion of the loss or damage as the amount hereby insured bears to the whole amount insured thereon, whether such other insurance contains a similar clause or not."

e IMPROVEMENT OR BETTERMENT PERMIT.

"In the event of fire causing loss or damage to assured's improvements, additions, stairways, ceilings, passageways, decorations or other betterments to leased building, or to machinery or fixtures installed therein at the expense of assured, the same shall be adjusted with and paid to the assured without reference to or contribution from insurance on the buildings. The intention of this policy is to place the insured, in the event of loss, in the position of that of absolute owner of said improvements, fixtures and machinery."

(NOTE. — While this permit is one that is not often used, it will avoid the opportunity for dispute that sometimes arises with owners of partly burned properties.)

VACANCY PERMIT.

Clauses waiving voidance under this condition are many and varied, ranging from the broad, unlimited Boston form to the restrictive permission used in the South, reading:

"Permission is hereby given that the premises herein described may remain vacant or unoccupied between occupants during the entire term of this policy.

"And in consideration of the increased hazard, by reason of such vacancy, it is hereby understood and agreed, that during such vacancy and in lieu of an extra charge therefor, one-third of the amount of the insurance hereunder shall be and is suspended and of no effect; and, during the vacancy hereby consented to, the amount of this policy is reduced to .... dollars (being two-thirds of original amount of insurance.)

"Provided, that when the premises herein described shall again become occupied, the amount of this policy shall be restored to the amount as at the date of this indorsement."

Any of these forms may be subject to time limitations, to additional premiums, or to stipulations regarding supervision of premises.

UNOCCUPANCY PERMITS.

Clauses granting this privilege can be very brief and simply read as follows:

"In consideration of $........... extra premium, permission is hereby given for the property insured under this policy to remain unoccupied for a period of .... from .... to ...."

Usually some stipulation as to care and supervision of the property follows this.

Cease Operation Permit.

A clause granting this privilege in a manufacturing plant will read as the unoccupancy permit just quoted, except that the word "idle" takes the place of "unoccupied," and a clause guaranteeing continuous watchman's service should be invariably required.

Overtime or Extra Hour Permits.

Clauses similar in arrangement to cease operation permits, but defining the extra hours for which the privilege is granted, are applicable to this condition.

Gasoline, etc., Permits.

Standard clauses designed to permit, and at the same time, to safeguard the storage or use of hazardous articles of the above class, are almost innumerable. I would refer you to the following adopted by the National Board of Fire Underwriters, as showing what may be granted along these lines and what restrictions or warranties should form a part of such permits.

Standard Form.

No. 15. Permits for buildings and contents when automobiles using gasoline are kept or stored.

No. 16. Permit for use of a gasoline engine.

No. 17. Permit for use of a gas machine, with outside carbureter.

No. 18. Permit for use of a gas machine, with inside carbureter.

No. 19. Permit for the use of gasoline lighting systems having outside tanks and inside flame heated generators.

No. 22. Permit for the use of gasoline lighting systems having inside tanks and inside flame heated generators.

No. 20. Permit for the use of fuel oil.

Features necessary for safe underwriting in the granting of these permits are brought out in them and suggest what must be required and guaranteed in the granting of such permission. These safety requirements are more matters of insurance engineering and chemical hazard than of economics.

Standard Policy—Clauses and Forms
Sixth Paper

BY

WILLIAM B. MEDLICOTT

Clauses of Exemption and of Warrant
Clauses of Title and Insurable Interest
Clauses for Special Emergencies

The various clauses which it is our purpose to discuss at this time, are divided, you will note, into three general classes each of which is capable of more or less sub-division. Taking them in the order I have mentioned, I would ask you to consider first the clauses that I have termed as being those of "exemption and of warrant."

Clauses of Exemption.

Clauses of this nature are ones that are used to exclude conditions that materially affect the hazard, and which are determining factors in arriving at the rate charged for insurance on the property involved. While the property covered is the same with or without the attachment of clauses of this nature, there are under certain conditions, extra features of hazard involved, of which if no mention was made or against which no exemption was taken, would legitimately be included under the policy as being insured against no matter what was the origin of the fire and whether these extra hazardous features were the cause of it or not.

Spontaneous Combustion.

One of the best illustrations of conditions of this sort is that of the familiar spontaneous combustion clause, a clause which you know is quite generally adopted in the insuring of bituminous coal or structures containing the same. While bituminous coal is subject to serious damage from fire that may originate through ordinary or external causes, it is also specially liable to fire from spontaneous combustion which carelessness in the handling or storing of it may cause to become a very present and serious menace to the coal itself and to the

surrounding property. Danger from loss of this character can, with proper care and watchfulness almost always be guarded against and prevented. On the other hand, carelessness on the part of the coal operator may cause, through the likelihood of spontaneous combustion, an undue amount of extra hazard. Realizing this, properties of this character are ordinarily rated in two ways. There is the rate on the coal yard or coal pocket itself and its contents, with no mention of any exemption, and there is an alternative and much lower rate that can be used if the policy distinctly states that in consideration of this lower rate, it is understood and agreed that the insuring company is not liable for loss that may be caused by the spontaneous combustion of bituminous coal on the assured's premises. Without such a clause, as we have described, loss from this special and constant danger is fully insured against, and since the risk of loss from this cause is such an eminent one, the hazard assumed by the insuring company is vastly increased. This is but one of the clauses of exemption. In it, the exemption exists in the agreement that claims will not be made for losses resulting from spontaneous fire in the coal.

The ordinary and simple form of clause ordinarily used in providing this exemption from spontaneous combustion liability; is worded substantially as follows:

"In consideration of the reduced rate at which this policy is written, it is mutually understood and agreed that this company is not liable for loss occasioned by the spontaneous combustion of bituminous coal on the premises of the assured."

Since we have by this illustration shown in a general way the purpose and working of a clause of exemption, it may be interesting for us to follow out the idea a little more fully, and since certain features of marine insurance illustrate these conditions more clearly, we may with profit, dwell on the workings of this extra hazard, as illustrated by marine insurance.

Attitude of Marine Policy.

Fire in ships may arise from a variety of causes, from lightning; spontaneous combustion of the cargo; negligence of the officers, or crew of the ship; from the acts of enemies; or even the precautionary means that sometimes are taken where a vessel is burned by municipal authority to avoid danger of infection from some contageous disease. Now, under the ordinary policy, in such cases, the insuring company is liable for loss occasioned by fire, whether its origin is explainable, or whether it can properly be assigned to either one of the above mentioned causes, or some other cause akin to them, with the exception of combustion generated through some inherent defect in the subject insured, that is the cargo of the vessel, or because such cargo was shipped in a dangerous or damaged state. If however, the cargo was properly defined and was in perfect condition

at the time of the shipment, and later on combustion resulted from the entrance of sea water upon said cargo and its effect on the same, it would be covered by the policy. In cases where certain goods were insured and fire originated in them under either of the conditions just described and such fire extended to other goods, or to the ship itself, the insurance on such other goods is responsible for the fire loss to them and the insurance on the ship could be held to pay the damage sustained by it.

We have cited this condition of fire loss under marine insurance as illustrating one feature that may be considered in connection with spontaneous combustion. If certain goods were damaged by a fire originating from spontaneous combustion in some exposing property, it would be wholly immaterial whether the properties affected by this exposing fire were subject to the provision of the spontaneous combustion clause or not, and even the fact that the property in which the fire originated carried insurance excluding damage from spontaneous combustion, would not relieve the companies insuring the exposing damaged property from liability. As we stated in our earlier comments on these clauses of exemption, they are designed not only to eliminate the consequences of certain severe hazards for the insurance company, but also, by their attachment to the policy, to effect a very material saving in the cost of insurance to the insured. Exemption clauses are wise, since they impose on the insured the necessity of his exercising proper care and supervision, which will almost invariably save him from losses that without such supervision, are likely to occur.

Consequential Damage.

Another proper field for the operation of clauses of exemption, is the one that is broadly termed "Consequential Damage" and in no better way can this be brought to your minds than by the use of another familiar illustration. Cold storage plants are almost invariably written with clauses of this character. Unusually in cold storage warehouses the low temperature that has to be maintained for the preservation of perishable merchandise (generally food stuffs of some sort or other) is produced by a refrigerating plant. Such damage by fire as might render the machinery of this refrigerating plant unable to operate, would result almost immediately in a rapid rise in temperature in the cold storage warerooms, and a consequent damage or total spoiling of the perishable contents.

Cold Storage Insurance.

If insurance is written on the contents of a cold storage warehouse simply describing the property insured, and the location in which it is insured and makes no mention of this conse-

quential damage, a loss resulting from a fire would find the insurance company liable, even though the fire itself did not reach the stored merchandise, but on account of the crippling of the refrigerating plant, had caused the destruction of the insured property through increased temperature. If on the other hand, the clause exempting from consequential damage was attached and the fire crippled the refrigerating plant and the merchandise was spoiled in consequence, there would be no liability attaching to the company.

This provision is a wise one for just the same reason that we have mentioned in connection with the spontaneous combustion clause. A refrigerating plant should be so constructed and arranged, and more than all, so supervised as to render its destruction by fire extremely unlikely, and the care necessary to prevent such destruction on the part of the cold storage warehouse men is one that it is not only proper, but fully encumbent upon them to exercise. Looking at it from the viewpoint of the insurance companies, absence of this clause of exemption leaves them open to a very severe loss from a fire, that not only is usually avoidable through proper care, but also one that may have been very trifling in the extent of the actual and direct fire damage which it caused. Many companies refuse to write cold storage merchandise without the attachment of this clause, and their position is an eminently proper one. The same questions which we raised relative to the effect on the rate by the combustion clause are applicable to the consequential damage feature. A clause covering conditions of this latter sort might properly read:

"This clause to be attached to all policies covering on merchandise, stocks or products in houses artificially cooled, other than solely by the storage of ice.

"Notice is hereby given, that it is understood and agreed, that the insurance under this policy does not extend in its application to cover, and this company shall not be liable for, any indirect or consequential loss or damage, including loss or damage caused by change of temperature resulting from, occasioned, or caused by the total or partial destruction by fire of the refrigerating or cooling apparatus, connections or supply pipes, nor by the interruption of the refrigerating or cooling processes from any cause."

You will note that this is purely a clause of exemption and not of warrant since the assured does not agree under it, to maintain any special supervision, process or device for the safeguarding of his property, but simply accepts the insurance with a definite understanding that it does not cover indirect or consequential damage resulting from injury to the refrigerating or cooling apparatus.

Greenhouse Insurance.

Another good illustration of the consequential damage feature, and one where the physical conditions are just reversed from those that we have cited, is that of greenhouse insurance. In winter weather the preservation of the contents of a greenhouse is of course, absolutely dependent on the heating system employed to maintain the proper temperature for the life and growth of the plants. Damage to the so-called "head house" or heating plant of the system might, as the result of a very small fire, cause an entire shut-down of the heating plant, producing a drop in temperature in the greenhouses themselves and as a result a lot of frozen vegetation. Consequently this hazard, which should be regarded in just the same way by the assured that the refrigerating plant fire should be and which should be constantly guarded against, is assumed properly by the assured himself. By changing the words, "refrigerating or cooling" to "heating and circulating" in the form cited for cold storage plants, we have a proper greenhouse consequental damage exemption clause.

Since consequential damage clauses apply almost wholly to contents rather than to buildings, it can readily be seen that the opportunity to get rid of an undesirable or unsalable stock is a very tempting one, because a small fire that only temporarily crippled and injured the warehouse or the greenhouse, would accomplish it. There is no easier way to dispose of a stock of bad eggs that the owner of the cold storage plant has discovered form a material part of the contents of his plant, than to have a small fire in the refrigerating building that would allow the temperature to rise to the spoiling point in the storeroom and then to make it appear that it was this circumstance and not one that previously existed, that actually caused the deterioration of the stock in question.

Fortunately perhaps, from this viewpoint of cold storage insurance, the owners and operators of the plant are usually different parties from those directly owning and insuring the contents, although not infrequently we find them to be the same persons.

Clauses of Warrant.

Clauses of warrant are ones that are applicable to those cases where special hazards of occupancy or equipment are assumed under the policy, with the understanding and agreement that losses from the ever present and exceptional risks associated with them, are fully covered, provided that in connection with these hazardous but permitted articles or devices, certain safeguarding methods are to be followed in connection with them. The disposition of this feature is not left in doubt. It is clearly stated as to just what the treatment shall be. You

can readily see that a clause of this nature is one that has to be very decidedly taken into account in the determining of a rate.

Acetylene Permits.

A good illustration of clauses of this nature is what is known as the "acetylene gas permit of warrant," and such a form reads:

"In consideration of the following warranties on the part of the assured, permission is hereby granted, when not in violation of any restriction imposed by law, to use acetylene gas on the premises described in this policy, generated by .... Acetylene Gas Machine, manufactured by ...., at .... provided the machine is contained in a separate and independent building located and constructed as per specifications printed on the back of this permit.

"The use of liquid acetylene or gas generated therefrom on the premises described herein is absolutely prohibited."

The permission granted under this form refers to the use of one of the most dangerous compounds ever introduced to the public, and one which should only be tolerated under severe restrictions. Therefore, a clause such as I have just quoted, is always accompanied by a set of warrants and cautions, the warrants stating how the acetylene generator and the calcium carbide used in it, shall be cared for and the cautions being matters of an educational nature relative to the special hazards of the acetylene.

These cautions are more matters of insurance engineering and the chemistry of fire hazards than of economics, and we will not discuss them here.

It is extremely important however, that there be attached to the policy as a part of the clause, these warranties and cautions, for they thereby become a part of the contract and violation of them materially weakens the position of the assured, and further safeguards the insuring company. In fact, since the warrants are essentially a part of the contract, any violation of them practically constitutes a voidance of the policy.

Gasolene Permits.

Much the same conditions exist in the case of printers and other parties who are likely to use benzine or similar cleaning compounds in connection with their business. Ordinarily, in rating properties of this sort quite a material advance is made for the assumption that there must be cleaning materials of this nature in the plant. Where, however, the assured feels that he can, and is willing to dispense with the use of them he is able to effect a considerable saving in the cost of his insurance by the attachment of a clause warranting that such materials shall not be used or kept by him during the life of the policy. Such a clause of warranty is the following:

"Warranted by the assured that no benzine, gasoline, mineral turpentine, naphtha or other product of petroleum, except refined coal oil of lawful test, shall be used or kept on the premises during the life of this policy."

The greatly extended use of automobiles and the provisions that it has been necessary to prescribe as to the way in which they shall be kept, housed and cared for, have called for warranty clauses defining and making a part of the contract the restrictions for safety which it has been deemed advisable to impose. Since it is these same gasolene or benzine features that are the ones of special hazard in connection with automobiles, the clauses of warrant are ones defining the methods used for filling and caring for the machines, and also limiting the quantity of gasolene that there may be in the insured premises at any one time. Clauses of this nature affect more generally the policies that are written to cover on the containing building rather than on the car itself, but they would be equally applicable to lines of fire insurance written covering the automobile specifically. Since in insuring automobiles it is generally desired to have one policy cover all classes of mishaps to which they may possibly be subjected, and since the marine form of policy the more readily admits of all of these conditions, direct insurance on automobiles is generally of the marine rather than of the straight fire type.

The special feature of warrant that we wish to impress here is that the warranty clause or rider attached to the policy which grants permission for either the storage or the use of any of the hazardous materials referred to shall at the same time, be restrictive in its nature and shall define clearly the conditions under which such hazardous materials shall be kept and used. In the event of a loss then, the fact that these restrictions and warrants are a part of the contract, gives the strongest sort of a defense in the event of a loss occurring from a fire directly attributable to a non-compliance with the warranty conditions.

Some Other Warranties.

Another class of warranties may be illustrated by a clause like the following:

"It is a condition of this policy and a warranty on the part of the assured that the dwelling above described shall be occupied by the owner and his family, and if occupied by any other party this policy shall be void and of no effect."

In this, you will note that the owner of the insured dwelling agrees that the dwelling against the loss of which he is insured, shall be occupied by himself and if he fails so to occupy it and rents, leases or permits its occupancy by any other party, the insurance immediately becomes void.

The clauses of warrant that are used in automatic sprinkler insurance further illustrate this warranty feature that we are speaking of. A form used for this purpose is the following:

"In consideration of the reduced rate of premium granted on the above described premises by the Underwriters Association of New York

State for the introduction of Automatic Sprinklers therein, it is hereby made a part of this policy that the assured (if the owner of the realty, or if, being a tenant, in control of the sprinkler equipment) shall maintain said Automatic Sprinkler System in good working order during the life of this insurance, and that no change shall be made in said Sprinkler Equipment or the water supply therefor without having first obtained the consent and approval of the said Underwriters' Association of New York State."

This form we have already alluded to in speaking of automatic sprinkler insurance, but it is interesting to note at this point the special warranty feature embodied. You see that the clause begins with the words "In consideration of the reduced rate, etc." This is always a wise provision in the framing of any warranty clause since it plays the same part in the conditions of the contract as do the words "value received" which are customarily used on promisory notes, or "In consideration of——————Dollars" that is commonly used as the opening phrase in a deed, or bill of sale. It recognizes that there has been a consideration between the parties and that in the case of an insurance policy the requirements are not made by the insurer without a consideration being given therefore. In this way the terms of the contract are very materially strengthened.

You will also note, referring again to this sprinkler warranty that the assured or whoever is in control of the sprinkler equipment, agrees to maintain said equipment in good working order and to make no change in its arrangement or effectiveness, without obtaining previous consent from the proper parties.

Still another form of warranty clause appears in what is called the "general sprinkler guarantee," a form that is especially applicable in places where official inspection of sprinkler equipments is both difficult and infrequent. A form to meet such conditions is the following:

"This policy having been issued at a reduced rate of premium on account of the installation of an Automatic Sprinkler Equipment in the premises described it is hereby made a condition of this policy that the assured shall use due diligence to maintain such Automatic Sprinkler System in good working order during the life of this policy."

This clause in addition to naming the consideration granted (that of reduced rate) includes a promise by the assured to use *due diligence* to maintain the sprinkler equipment in good working order during the life of the policy.

While due diligence is a pretty difficult thing to clearly define, and a still more difficult thing to prove the non-existence of in event of a loss a clause like this acts to quite an extent as a safeguard and in some instances, as a defense against losses that are directly due to the assured's own carelessness and neglect, and his going back on his pledge and at the same time violating a provision of the standard policy contract.

Electric Warranties.

We would also call your attention to the warranties that are commonly used in connection with electrical equipments. In these clauses not only is permission given to use electricity for lighting or other purposes, but accompanying this permission is a warranty on the part of the assured as to the nature of the installation of the electrical equipment, and also a pledge as to the way in which it shall be maintained.

The Important Feature of Warranties and Exemptions.

The all-important thing to bear in mind in connection with any of these clauses of exemption and warrant is to see to it that they are so worded that they not only become an actual part of the contract itself, but that they define clearly what is allowed, to what extent it is allowed, and the conditions guaranteed to be maintained on account of its allowance. Of course restrictions of this sort relate only to those material devices or processes that the voidance provisions of the policy cite as a cause for the immediate nullifying of the contract of insurance.

Clauses of Title and Insurable Interest.

Under this topic your attention is directed to clauses that are frequently used recognizing other interests than those of sole and unconditional ownership. Also clauses stating if the subject of insurance be a building, that it is located on leased land (if such is the case), and also clauses which may grant any different right, or rights, of subrogation than those that are especially outlined in the body of the policy or that may waive this right. The provisions of the New York standard form of policy call for greater explicitness in clauses of this nature than do those that form a part of the Massachusetts standard.

Massachusetts Policy Provisions.

The latter form you will note, states that the policy, "shall be void if any material fact or circumstance, stated in writing has not been fairly represented by the assured." Further than that there is no restriction as to the presence of mortgages or liens of any kind on the property, or to the fact that the building (if the subject of the insurance be a building) is standing on land owned by someone other than the owner of the building itself.

In the event of a loss occurring where any of these conditions exist and where the policy contract in use is of the Massachusetts form, it always raises a question in the event of a dispute arising as to the validity of the claim under this provision,

as to whether in the particular case under consideration, the withholding of the information as to a mortgage or a lien, or leased land was a material fact or circumstance, and if the Court should decide that it was not, and that it created no increase of hazard, there usually can be no successful defense set up.

New York Policy Provisions.

Turning to the New York standard form we find these provisions of the policy very much more clearly defined. For example, the policy will be void "If the interest of the insured be other than unconditional and sole ownership, or if the subject of insurance be a building on ground not owned by the insured in fee simple, or if the subject of insurance be personal property, and be or become encumbered by a chattel mortgage, or if, with the knowledge of the insured, foreclosure proceedings be commenced or notice given of sale of any property covered by this policy by virtue of any mortgage or trust deed." You will note how much more clearly the voidance conditions that relate to title and ownership are defined in this New York standard form than is the case in that of Massachusetts. In considering clauses that recognize these varying conditions of title and ownership, if we see to it that they comply with the New York provisions, we are sure to be on the safe side in all cases.

Mortgagee Interests

The most frequent of the clauses relating to the title of the insured property are those that recognize other interests, these apply mainly to buildings and are usually those of a mortgagee or in the case of personal property the conditions that are imposed by a so-called chattel mortgage. For purposes of safety and to give additional security to a creditor, policies are at times made payable to such creditor even though he does not have a formal lien on the property by virtue of a duly recorded mortgage or assignment. In cases of this sort a very simple clause will suffice, and such a clause is usually termed the "loss payable clause" and only states that "loss, if any is payable to————as his interest may appear." Should a loss occur the insuring company noting this clause on its policy will, in making out its draft in payment include not only the name of the assured, that is the party to whom the policy directly runs, but will also include on the draft or check, the name of the payee mentioned.

When a mortgage exists it is desirable to be somewhat more explicit than this in order to make clear that the provision of the standard policy as to sole and unconditional ownership,

has not been ignored in the taking out of the insurance, and mortgagee clauses are usually written in one of two different forms. The first in what is ordinarily spoken of as simply the mortgagee form, and reads as follows:

"$.......... On his interest as mortgagee on the four-story brick building situated and known as Nos. .... It is agreed that whenever this company shall pay to the mortgagee any loss under this policy and shall claim that as to the mortgagor or owner, no liability existed, it shall at once be legally subrogated to all the rights of the mortgagee under any and all obligations to the mortgage debt to the extent of such payment, or at its option may pay the whole principal and interest due on the mortgage, and shall thereupon receive a full assignment and transfer of the mortgage, and all other obligations held as security or collateral for the mortgage debt, but no such subrogation shall impair the right of the mortgagee to recover the full amount of his claim."

In contrast to this form clauses are in common use in many of the states which are very much more explicit, and of which the following is a sample:

Mortgage Clause With Full Contribution.

"Loss if any payable to .... Bank as mortgagee (or trustee) as interest may appear, and this insurance, as to the interest of the mortgagee (or trustee) only therein, shall not be invalidated by any act or neglect of the mortgagor or the owner of the within described property, nor by any foreclosure or other proceedings or notice of sale relating to the property, nor by any change in the title or ownership of the property, nor by the occupation of the premises for purposes more hazardous than are permitted by this policy. Provided, that in case the mortgagor or owner shall neglect to pay any premium due under this policy the mortgagee (or trustee) shall, on demand, pay the same."

This is only a part of the full contribution mortgage clause. It also contains the following provisions, that the mortgagee (or trustee) must notify the company of any change of ownership or occupancy, or increase of hazard. Also that he shall be liable on demand for additional premium due to such increased hazard, and that if he does not properly attend to this feature the policy shall be void. Under this form, too, the company further reserves the right by a special clause to cancel the policy at any time, as prescribed by the standard policy, but that in such case the policy will continue in force for the benefit of the mortgagee for ten days after notice may have been served on him, after which time his rights under the policy cease. This full contribution clause still further provides as to the relation which other insurance on the property shall bear to loss or damage sustained when held by parties having an insurable interest therein, whether as owners or mortgagees. This is a very important provision of the full contribution clause for it prevents any company from being obliged to pay possibly, a total loss to a mortgagee where the other insurance upon the same property in which the mortgagee has no interest, may get off with a very trifling contribution.

Both of these forms carry with them the right for the company paying a loss to the mortgagee to be immediately subrogated to all the rights that the mortgagee formerly held. This usually means that if the insuring company shall pay to the mortgagee the full amount of his mortgage, they will immediately be placed in the position of mortgagees and have the same lien upon the property that formed the collateral for the mortgage, that the mortgagees themselves had.

Mortgagee interests are so varied and the conditions under which mortgage loans are made, are of such different natures that a wide variety of phrasing has crept into the co-called mortgagee clauses, though essentially they are one or the other of the two types of clauses that we have just spoken of, that is those either with or without the full contribution feature. Whenever possible it is of course, in the interests of the insuring company to secure the attachment of the full contribution clause, especially where there may be a doubt as to the placing of the payee or mortgagee clause on all the other policies covering the same property. At times too, it is desirable for the mortgagee to have made a part of the clause the words "under present or any future mortgages." This clause, where for example, on a building in course of construction additional monies may be advanced from time to time as the work progresses, is a safeguard to both the mortgagor and the mortgagee and is not objectional to the insuring company.

A somewhat unusual clause in connection with mortgagee interests is the so-called "clause of consent," reading:

"At the request of the insured this company hereby consents that loss, if any, under this policy, shall be payable to .... (subject to Mortgagee Clause attached) not intending to waive and not thereby waiving, any previous rights, privileges or equities secured to this company by the terms and stipulations of this policy."

Clauses of this nature may be attached after the date of the policy and call for them is brought about by the fact that a property on which there is already existing insurance, has become subject to a mortgage, and the insuring company is asked to consent to the payment of the loss if any, to the mortgagee but at the same time you will note that it does not waive any of the previous rights or privileges that might accrue to it under the original policy contract.

With any payee clause, whether to a mortgagee or anyone else, the condition for the insuring company to be sure of is as to the relation of the lien to sound value. In other words, what is the equity in the property of the designated owner?

Buildings on Leased Land.

The clauses relating to the leased land feature in order to meet the provisions of the New York policy is very simple, and perhaps is more properly a part of the descriptive form

attaching to the policy than a clause of title. It simply states that the insured building stands on leased land. More than that it is not necessary to say anything, though the careful underwriter will of course, at once seek to find out what are the conditions of the lease under which the building is allowed to stand on land belonging to someone other than the actual owner of such building. Simply stating that the building is on leased land discloses the condition required by the New York standard form in order to prevent a voidance of the contract. While it is not essential here in Massachusetts to disclose this fact, so far as a voidance of the policy goes, it is in justice to the insuring company, a feature that should be known since in many cases it is a material fact or circumstance affecting the property.

Subrogation.

Clauses of subrogation are not used to any great extent because the right to subrogate is clearly granted under both of the standard forms of policy that we have been especially considering. In Massachusetts no restriction is placed other than the extent of the amount paid on the loss, as to the rights to recover under subrogation from any party against whom the assured may feel that he has a claim, usually on account of negligence contributory to the fire. In New York State the further restriction is placed that the insuring company can only claim this right of subrogation (and to the same extent as in Massachusetts) when they are ready to claim that the fire was caused by the act or neglect of some third party.

Clauses waiving the right to subrogate are becoming more frequent and are especially so in policies on manufacturing plants located on land leased from or controlled by a railroad. Such clauses are agreements on the part of the assured not to grant the right of subrogation against the railroad, and are usually and rightfully subject to an additional premium.

Clauses For Special Emergencies.

Probably the most interesting clauses that we have for consideration at this time are those that in a general way, may be termed clauses for special emergencies. Under this head I allude to clauses that are drafted for use as binders and clauses aiming to cover or to exclude losses due to earthquake, or explosions or some other disaster. In a certain sense all clauses of this special emergency type are ones of permission, since they grant special privileges not ordinarily contemplated under the standard contract.

Binders.

The first of these special emergency conditions that we will consider is that where a binder is required. You all know how important it often is to be able to protect by insurance at a moment's notice some property that it is not possible at the time for an insurer to immediately issue a policy on; merchandise perhaps, that is being delivered at short notice into a warehouse where the rate is not yet known, or where other features necessary to the completion of the policy contract are still matters of doubt. Under these conditions, the binder (an every day occurrence) naturally comes into use. There is no special clause or form prescribed for this special emergency instrument. The simple acknowledgment by an authorized agent, or official, that he is holding binding a certain amount in his company on a specified property owned by the party in whose interest the insurance is being asked, and located in a properly defined place, or places, is all that is necessary, and while such binders are usually in the form of simple written agreements, a verbal binder is in the eyes of the law, fully as binding as if it was the subject matter of a full fledged legal document. There would be no use in prescribing any set form or clause to be used in the phrasing of binders, for since the emergencies under which they are called into use, are almost always sudden and unexpected, no one would think of living up to any such prescribed form or clause, but the Courts have clearly defined that the act of issuing a binder is of absolutely the same importance, except in that of form, as is the writing and delivering of a policy. Binders, it must be remembered, are subject to the same conditions over cancellation that obtain with policies.

Earthquakes and Disturbances of Nature.

Emergencies such as arise under conditions of fire losses attendent upon an earthquake, raise questions of intense interest, and those of us who spent many weeks in connection with the losses at San Francisco in 1906, have good reason to believe that the effect of earthquake conditions on the insurance contract is truly a most puzzling one. The standard policy as ordinarily drafted, lists a number of special emergency conditions, such as invasion, insurrection, riot, civil war, military or usurped power and explosion of any kind.

In some instances companies have felt that loss resulting from fire caused by an earthquake could be satisfactorily voided in the policy contract by the simple insertion of the word "earthquake" along with the "civil war, insurrection," etc., features of the policy. Experience has clearly shown though, and it was demonstrated over and over again in San Francisco, that the insertion of this word did not necessarily void the contract.

The burden of proof was at once thrown upon insuring companies. Did, or did not, the fire that destroyed the subject of the insurance start from earthquake? Supposing too, that the earthquake did cause a fire in a certain building, and that from that building the fire passed on to an entirely separate property belonging to another party and destroyed it. The cause of the destroying fire to the last mentioned building could simply be set down as fire in an exposing building. Even were the insurers always able to prove clearly that the origin of the fire was from the earthquake, (a condition that it is almost impossible to prove when earthquake conditions exist) then in cases like that of the second building there would still be no ground for dispute.

Whether or no, a clause can ever be effectively drafted by insurers that will void the policy in the event of an earthquake, seems to be a matter of grave doubt. The strongest form of clause yet devised, and the one that was in use with many companies in Jamaica at the time of the Kingston earthquake a few years ago, reads like this:

> "In consideration of the reduced rate at which this policy is written, it is hereby mutually understood and agreed that in the event of an earthquake, this policy shall immediately cease, and be void and shall so remain for a period, (usually, I believe) of seventy-two hours."

It would certainly seem as if, should a fire immediately follow an earthquake, that a clause of this kind forming a part of the policy contract, absolutely voided the same and thoroughly safeguarded the insuring company, but even this clause has not proved infallible by any means for the claim was made in Jamaica that at the time the earthquake occurred there was a fire that had just started in one of the buildings that afterwards fell down, and that therefore, at the time the fire began, which evidently destroyed a large part of the city, the insurance was in force, and the contract effective. Illustrations can be multiplied without number, and many of them extremely interesting, as illustrating not only the ingenuity of the underwriters, but the difficulties of drafting a clause that can truly be said to be earthquake proof.

Fallen Buildings.

Another interesting feature that arises in connection with earthquake losses is that of fallen buildings. There is burned in the minds of all who were in San Francisco in the year 1906, the words, "If a building or any part thereof fall, except as the result of fire, insurance by this policy on such building or its contents shall immediately cease." What a troublesome clause this was to the San Francisco adjusters! Not only was it very difficult after a building had been destroyed by fire to prove whether or not it was a standing or a fallen building at the time the fire reached it, but also the words "Any part thereof" was

the cause of constant dispute between claimants and those adjusters who were seeking to make salvages on any possible pretext, some claiming that where a chimney tipped over, or where a cornice was somewhat injured, or some of the plastering inside the building had fallen that a voidance of the policy was thereby constituted and that there was no insurance in force at the time the fire reached it. There were cases of this sort where there was undisputable proof that the building had been more or less damaged before it burned, but the unreasonableness of maintaining that because a chimney for example, had fallen above the roof, that necessarily such building had become unprotected by the policy taken out to safeguard it, was one that the more reputable companies did not seek to make a defense of. The usual course of procedure among these companies, if there was any evidence that the building was in a damaged condition before the fire reached it, was to arrive as satisfactorily as might be at the value of the building in its damaged condition, and adjust the insurance upon that basis.

Before leaving this subject of earthquakes, I would call your attention to a form that I see is in use in some places designed to meet this earthquake condition. This form reads:

"This Company shall not be liable for loss or damage occasioned by or through any volcano, earthquake, hurricane or other eruption, convulsion or disturbance of nature."

My only comment on this form is that it is useless for just such reasons as we have already stated.

Explosions.

Just a word on one of the other special emergency cases for which clauses are occasionally designed, I refer to explosion. Damage caused by explosion is clearly not covered by the standard policy according to its own phraseology. If the explosion is the result of a fire that is already under way, the fire being the direct cause of the explosion, and the explosion simply being, as we might say, a part of the fire damage, the fire policy is of course, directly liable, but if the conditions are reversed and an explosion occurs which causes the fire, then the intent of the policy is clearly that a voidance has been constituted, and that there is therefor no liability. You can readily see that the same conditions of doubt and difficulty of proof will at once come up in cases of this sort that occur under earthquake conditions and the same line of reasoning that we spoke of in connection with earthquake clauses is equally applicable here. A great many extremely interesting features have come up in connection with fire losses where there were explosions. One of these is the well known Tarrant case in New York which was the subject of much litigation. A conflagration originated in the Tarrant building itself, these people being wholesale druggists. After burning an hour or so, the

fire reached a large stock of explosive drugs and chemicals. The effects of this explosion were so severe that all the neighboring buildings were wrecked, and in the case of the owners of one of these buildings, litigation ensued, the insuring company taking the ground that the building was destroyed by explosion and not by fire. The building in question was over fifty feet away from the Tarrant building; there were other buildings between it and the building in which the fire originated, and also a narrow street. Both of the intervening buildings were blown down by the explosion and the ruins of them, as well as of the building over which litigation was pending, were completely burned. In this particular case the lower Court found for the owner on the ground that though his building was wrecked by an explosion, that a fire was the cause of the explosion and that, therefore, the insuring company was liable. On an appeal, the higher Court reversed this decision and held that the loss was by explosion, not by fire, and that therefore, under the provision in the standard policy, the insuring company was not liable. Probably I have said enough about these special emergencies to cause you to realize that the working out of clauses that may be designed to guard against or to provide for them, are extremely uncertain as to their outcome.

The special form adopted in some localities to include coverage of loss caused by explosion reads as follows:

Explosion Clause.

"In consideration of an additional premium equal to ten per cent. of the amount of premium otherwise due on this policy it is agreed that in the event of any explosion, fire ensuing, this Company shall pay the loss on the property hereby insured, if injured by fire, at the value thereof before the explosion; provided that if there be other insurance upon the property damaged this Company shall be liable only for such proportion of the loss or damage as the amount hereby insured bears to the whole amount insured thereon, whether such other insurance contains a similar clause or not."

"Attached to policy No............., ...Ins. Co."

The principal criticism that we have to express regarding this is that a premium based on a percentage is likely to be absurd. Explosion effects may be fully as serious in a high grade low rated property as on a poor, high rated risk. Hence the assuming of this extra hazard for perhaps one or two cents a year approaches an absurdity. My own idea is that an adequate flat charge should replace the percentage.

Some Further Emergency Clauses.

Of the making of fire insurance clauses there is no end. New processes of manufacture, changed methods of business, the enactment of more rigid building laws, etc., etc., all tend to create conditions which have a direct effect on the liability assumed by the insurance companies and often constitute a

material increase of hazard. It would not be possible at this time to attempt to enumerate even a small portion of these increasing emergency conditions, but we may with profit call attention to two or three that are being forcibly brought to the attention of underwriters at the present time, viz.; demolition and disclaimer clauses, cotton insurance clauses, and subway permit clauses.

Demolition and Disclaimer.

The call for clauses of this character is an outcome of state or municipal laws governing the repair of damaged buildings. When cities and towns are in their beginnings and are not congested by the crowding together of buildings, any type of structure that its owner saw fit to erect was allowed. The result is an excess of frame, or light masonry construction, with no fire retarding devices, with combustible roofs and in short every kind of quick burning construction imaginable. As cities have grown the menace to life and property from this cause being recognized by the state or city authorities has caused the adoption of building laws prescribing standards of construction that not only must be lived up to in the erection of new buildings, but which must also be carried out if any material change or repair is to be made on an already standing structure. Now it is one thing to repair a damaged building by putting it back into the condition it was in before a fire by the use of materials of the kind, quality and arrangement that formerly obtained, but quite another and a far more expensive thing to replace by the use of the higher grade materials, built up under the improved methods that the new building laws require. A notable illustration of this is the oft mentioned advertiser building claim in Boston some years ago. This building suffered from fire, the loss was adjusted in usual course but the owners objected to the award because it only paid them for the actual damage sustained by the building as it was at the time the fire occurred. That is the insurance companies agreed to pay what it would cost to put the building back in the same shape it was before the fire. Surely under a policy of indemnity worded as both the New York and Massachusetts policies are it would seem as if nothing more could justly be claimed. The assured, however said, "but we cannot put the building back in the same condition it was in; the law will not allow it, therefore since the fire is the direct cause of our having to go to the additional expense, the fire policies should meet it." Seemingly this throws the indemnity feature of the contract one side, and wholly ignores the wording of the policy. I understand that the main question at issue, that is — "are the fire insurance companies liable for such increased cost of repair where it has not been assumed by special clause or rider attached to the policies" — has never been directly decided by the Courts.

A recent case makes it appear that the companies cannot be held, but this particular case was so involved with other questions at issue that it can hardly be regarded as final. In the advertiser case referred to the question was argued before a master and while he ruled that the companies must pay the increased costs, there is no certainty that the Courts might not have ruled otherwise. The fact that the master's finding in this much cited case did not necessarily and forever remove this doubt, has caused both underwriters and property owners to seek to have clauses affixed to their policies that would leave no uncertainty. The underwriters sought to have on all policies that they issued on buildings not up to the standard required by law and situated in the areas where such law applied a so-called disclaimer clause reading:

Disclaimer Clause.

"In consideration of the reduced rate at which this policy is written it is stipulated and made a condition of this contract that, unless such liability is assumed by rider attached to this policy, this Company shall not be liable for loss under this policy beyond the actual value of the property herein described at the time any loss or damage occurs, nor beyond what it would then cost the assured to repair said property, or to restore it to the condition in which it was immediately before such loss occurred, using material of like kind and quality, and in either case making suitable allowance for depreciation from any cause; nor for loss occasioned by ordinance or law regulating construction or repair of buildings."

The object of this clause is apparent. It distinctly emphasizes the indemnity feature of the contract and it limits the insurance companies' liability to the amount necessary to put the building back into the same condition it was before the fire. In fact it appears to prevent beyond a doubt the collection of any increased expense due to the enforcement of laws calling for a better building.

The property owners also feeling doubtful that the master's decision in the advertiser case secured to them the certainty that the insurance companies must pay the increased cost of repair, called for a rider on their policies whereby the companies agreed to admit it as a part of the expense for which they were liable. Now it is very apparent that if this liability must be assumed, it would call for greatly increased payments under the policies in event of fire, hence it is a something for which an increased premium should be paid. The clause now used to protect the building owner and to provide proper compensation for the insurance company is called:

Demolition and Increased Cost of Construction.

"In consideration of .... dollars additional premium this Company shall be liable, in case of loss or damage under this policy, for loss or damage occasioned by the enforcement of any State or Municipal law or ordinance regulating the construction or repair of buildings and in

force at the time such loss occurs which necessitates, in rebuilding, the demolition of any portion of the insured premises which has not suffered damage under this policy, and this Company shall also be liable for the additional cost of repair or reconstruction, due to the enforcement of such law or ordinance, or portions of the insured premises which have suffered damage, but the total liability of this Company under this policy shall not exceed the amount for which this policy is issued, nor such proportion of the actual value, prior to the fire, of the property insured hereby, nor of any loss thereto, as the amount of this policy bears to the total insurance covering on the property described in this policy, whether such insurance all contains the foregoing clause, or is on the same interest as that described in this policy or not.

"If this policy covers more than one building the foregoing liability shall attach to each building separately, not exceeding the amount specifically insured thereon, or if it does not attach on each building in a specific amount, in proportion as the sound value of each building bears to the sound value of all."

From this you will note that the insurance company agrees to admit liability because of a specified consideration paid therefore.

With many companies the disclaimer is mandatory on all policies on which an increased repair cost clause could be made. The demolition clause is optional with the building owner. If he wants it and will pay for it he can have it.

Special modifications of both the demolition and increased costs of construction clause and the disclaimer clause are used to make it apply on policies covering rent, leasehold interest and use and occupancy insurance in buildings where increased cost of repair conditions such as we have described could exist; and affect the amount to be paid by the insurance company.

Another interesting special emergency clause in use in our southern states is the:

Cotton Insurance Clause.

A very large portion of our southern cotton has annually gone to British or European mills. The present war has prevented its sale and shipment and in consequence the cotton growers and dealers in the south are loaded up with unsold cotton, and no immediate prospects of a market. A serious moral hazard therefore exists, and the insurance companies at once foresaw that they were likely to be the only medium by which this cotton could be turned into cash. How can this danger be averted? Obviously it would be unjust and prejudicial to refuse altogether to insure this enormous cotton stock, but it was equally clear that some clause must be used on the fire policies to reduce to a minimum the temptation to unload on the insurance companies by those whose honesty might be unequal to the strain.

Several restrictive clauses as to storage, limitation of value per pound, etc., were more or less used, but probably the most effective of all in keeping down the fire waste was the following:

Cotton Replacement Clause.

"Notice is hereby given that in the event of loss under this policy this Company has the right to replace with Cotton of like kind and quality the cotton that may be damaged or destroyed by fire as provided for under the printed conditions of the policy."

This clause you will note places the assured where if he had a loss he might still find himself without the desired cash, but in possession of the same quantity and quality of cotton that he owned before the fire. Whether or no it was wholly in consequence of this clause that the dreaded moral hazard losses on cotton were averted we cannot say. We can state though that there was no abnormal loss on this commodity and assumably the clause was a deterrent factor.

Other requirements in connection with this clause were called for by many insurance companies. Such as an absolute demand for adequate co-insurance and an agreed price per pound for a certain grade of cotton to serve as a basis for the replacement value.

One more special emergency clause to illustrate the means taken to guard against another "modern improvement" hazard, I refer to the

Subway Permit.

"In consideration of .... the same being .... cents upon each one hundred ($100) dollars of insurance carried by this Company on the herein described property, permission is given to make such alterations and these only on the building ...., ... Street as may be necessary in connection with the work of constructing the so-called ....;
"Attached to policy No. ....Ins. Co."

Probably no comment is necessary to make more clear the purpose of this clause. Still a word may not be amiss. The construction of subways, especially under narrow streets where the abutting buildings are high and heavy, calls for especial construction work in reinforcing or shoring foundations. If this were not done damage from settlement might take place which in turn would cause fire. Possibly the ordinary clause for building or repair might cover this, or the exemption clause in the policy relating to fire caused indirectly by "civil authority." Either of these restrictions however, might prove inadequate to the mind of the court in event of litigation hence it was deemed wise to draft a special clause like the above to make clear beyond question the intent of the policy.

Standard Policy—Clauses and Forms
Seventh Paper

BY

WILLIAM B. MEDLICOTT

Clauses of Distribution and of Liability Limitation

No class of clauses in common use with fire insurance policies are so essential and at the same time, so much the subject of criticism as those that are designed to define in an equitable manner the extent of the liability of the insuring company and at the same time place the contract on such a footing that its proper cost or rate can be determined. By distribution, liability and limitation, we mean clauses like the following: the three-fourths value clause; the three-fourths loss clause; the average clause; and the co-insurance, or reduced rate, or assessed value clause, these last three names applying to one and the same provision.

The Three-Fourths Value Clause.

Taking up in the order named the various clauses mentioned, we will refer briefly to the three-fourths value clause, the ordinary form of this being substantially the following:

Three-Fourths Value and Limitation Clause.

"It is a part of the consideration of this policy, and the basis upon which the rate of premium is fixed that in the event of loss, this company shall not be liable for an amount greater than three-fourths of the actual cash value of the property covered by this policy at the time of such loss in case of other insurance (consent to which must in all cases be indorsed hereon) the company shall, whether policies are concurrent or not, be liable for only its pro rata proportion of such three-fourths value."

You will note that the title of this clause is that of three-fourths value and limitation. You will also note that the attachment of a clause of this character forms a part of the consideration that enters into the fixing of the rate on properties to which it applied. With such a clause the rate can be materially reduced because as the clause distinctly states, "the company shall not be liable for an amount greater than three-fourths of the actual cash value." Also in the event of there being insurance in more than one company, this same three-fourths of the total

sound value must be regarded as the total insurable value of the property at the time the loss occurs and the insurance must pro rate upon that basis.

While this clause is emphatically one of limitation, its prime object is to compel the assured to carry a part of the risk himself, and it also very effectively does away with any possibility of gain coming to him by means of over insurance. It is a clause that is especially applicable in classes of risks where the average of loss has been unduly high, and yet where proper care and supervision on the part of the assured would probably have prevented a great number of these losses. Possibly the most notable class of risks that have been subjected to the attachment of this clause are the paper mills of the earlier days, where losses were so frequent and the insurance regarded as so undesirable by insurers, that the companies, as a matter of self preservation, found it necessary to attach a clause of this nature to the policies to prevent an excessive loss ratio from the class. Clauses of this nature were among the first that were designed to make the insured a sharer in carrying the burden of his own fire loss. They tend to reduce the moral hazard and make imperative the care and protection that the assured always should exercise.

The Three-Fourths Loss Clause.

The next clause that we listed is called the three-fourths loss clause. A clause of this nature is one that limits the liability of the insuring companies to three-fourths of the total loss sustained, and in this way makes the assured carry a part of his own risk in much the same manner that the three-fourths value clause does. Neither of these clauses are in as common use today as they formerly were, since the classes of property to which they are more directly applicable are now largely under the protection of automatic sprinklers and are subject to the co-insurance or reduced rate clause.

Average and Co-insurance.

By far the more important part of this discussion should be directed to the so-called average clause and the co-insurance clause. The use of the word "average," in connection with clauses attached to policies of insurance, appears to be a varying one in different localities. In this country, we uniformly I believe, regard an average clause as one that distributes the liability of the company by apportioning under some prescribed rule, just what part of the insurance shall apply in any specified locality, or on any specially defined property. In this way it becomes to a certain extent, a distribution clause. In contrast to this definition of what we mean by an average clause, is one

that obtains to some extent in countries where the same meaning is given to the term "average" that we apply to a clause of full co-insurance, or that is, what we would term a 100% clause.

Before we discuss these differences it will be best for us to quote each one of these clauses as they are commonly applied in this country. The average clause reads as follows, and is applicable to blanket or compound forms of insurance:

The Average Clause.

"This policy is attached in each building or locality in proportion as the value in each bears to that in all."

Now to illustrate let us suppose that a policy for $9,000 was written covering merchandise contained in three different buildings and written with an average clause. At the time of a fire in building No. 2, it was found that building No. 1, contained merchandise to a value of $5,000, No. 2 $4,000, No. 3 $3,000 or that is all of the three buildings contained stocks to a total value of $12,000. Under these conditions, one-third of the policy of $9,000 or that is $3,000 would be the insurance covering directly in No. 2, the burned building, because four thousand twelve-thousandths equals one-third. This illustration certainly makes it appear that the average clause is also a clause of distribution, and it also is a clause of limitation since it fixes the limit under which any policy, or policies, can be made liable in any one particular place or on any one specified property.

The Co-insurance Clause.

Before we speak more fully of the difference in its limiting features between the average and the co-insurance or reduced rate clause, let us quote one of the latter. The forms generally used read like this:

"In consideration of the reduced rate at which this policy is written, it is expressly stipulated and made a condition of the contract that in the event of loss this Company shall be liable for no greater proportion thereof than the amount hereby insured bears to .... per cent. of the actual value of the property described herein, at the time when such loss shall happen, nor for more than the proportion which this policy bears to the total insurance thereon; provided, however, that if the aggregate claim for any loss shall not exceed 5 per cent. of such actual value no special inventory or appraisement of the undamaged property shall be required.

"If this policy be divided into two or more items, the foregoing conditions shall apply to each item separately, and if two or more buildings or their contents be included in a single item the application of the provision as to special inventory or appraisement shall be limited to each building and its contents."

It is claimed by some that this co-insurance clause is not only a clause of limitation, but that it is also one of distribution, the contention being based on the words "Nor for more than

the proportion which this policy bears to the total insurance thereon," it being argued that in the case of a blanket policy covering several properties, that when a loss occurs on some one of these properties on which there is specific insurance covering only on that one, that the presence of a co-insurance clause virtually fixes that part of the blanket policy that can be assessed under conditions such as we have described; the contention being that the words "Nor for more than the proportion which this policy bears to the total insurance thereon," being equivalent to the average clause in dividing the blanket policy into specific parts instead of the entire blanket policy being liable to be called upon to contribute on any one, or all of the properties on which it covers.

The general interpretation, however, of this portion of the reduced rate clause that we are speaking of is the reverse of this, and simply limits the maximum for which the policy carrying this clause can be liable in the same way that the limitation clause in the standard policy contract, limits the liability on any one policy by the use of the words, in the Massachusetts policy, "that, if there shall be any other insurance, the insured can recover on this policy no greater proportion of the loss sustained than the sum hereby insured bears to the whole amount insured thereon." Substantially the New York standard policy limitation clause is the same only as is usual in the New York form, it is more explicit and goes further into details in defining the nature and extent of this liability. This makes the entire blanket insurance assessible on its full face for contribution for loss on any one of the properties to which it may apply.

Average Clause is One of Distribution and Limitation; Co-insurance One of Limitation Only.

To me, it seems clear that the average clause is a clause of both distribution and limitation; of distribution in that it opportions the amount of insurance that is applicable to any particular subject; and of limitation in that, by this distribution, it states just what portion of the total policy can be assessed in one loss. While the co-insurance clause is purely a clause of liability limitation, in that it fixes definitely the amount for which the insuring company can be liable with reference to conditions of sound value, loss and amount of insurance carried. This almost always causes the blanket insurance to suffer where there are both specific and blanket policies covering on the same group of properties and only a portion of the group is damaged by a fire.

Another form of so-called average clause in use, especially in connection with lumber insurance, reads as follows:

"It is understood and agreed that no claim under this policy shall be for a greater proportion of the whole loss or damage to the property insured thereby, than the amount insured thereby shall bear to the whole value of the property insured at the time of the fire."

This form of average clause may be said to also possess certain of the limitation features. In fact, in its effect on the recovery at the time of a loss it would operate in much the same way that a three-quarters value clause would, although based on a different principle.

Essential Features of Co-insurance.

The co-insurance clause is vastly more essential to proper underwriting than the majority of the people using it begin to realize. Possibly, a word or two in justification to this clause may not be amiss here, since it is the subject of such general criticism. That it is a necessity is evidenced by the fact that a good many years ago in England, an act was passed by which parties taking out insurance were obliged to place a fixed amount upon each separate building or contents itemized, or where the fixing of such an amount was not practicable an account of the stock being of a movable character, changing its location from time to time, or, if from any other cause, and the insurance was in one sum over all, the insured in such cases was only to recover pro rata for any damage in the proportion that the insurance on the damaged property at the time of the fire, bore to the whole value of the insured property. It is nearly one hundred years since this position was taken up and legalized by English statute, but you can see that it recognized the principle that there was a relation between insurance carried and sound value of property covered, that must be to some extent, a definitely fixed relation in order to have the business of underwriting placed upon a sound economic basis, and to enable insurers to know what to charge for their policies.

Quite a common opinion among policyholders regarding co-insurance, you know, is that it is unreasonable and unjustifiable and that if we are willing to insure a man for $1,000 it should make no difference whatever, to us whether the property that we insure him against the loss of was worth $1,000 or $5,000 or $10,000. This is the popular argument against co-insurance, the assured ofttimes maintaining that it should make no difference to us if we are willing to run $1,000 worth of risk on his property, as to what the value of that property was so long as under anything but a valued policy, there was at least $1,000 worth of it in existence. But think a moment. In the case of a $5,000 property with $1,000 thereon, and a 20% property loss, there is a total loss for the company; in the case of $10,000 property value with the same $1,000 insurance thereon and a 10% loss, a total loss for the company again. In other words, since the great majority of losses (probably upwards of 90%

of them) are not total losses, and among this 90% of partial claims are losses ranging everywhere from fractions of 1% up to 99% of the value of the insured property, the great majority of them being under 10% or at the most 20% in extent, the company writing a small line such as we have spoken of on a property of high value, stands liable in the great majority of the losses that may occur to have them prove total losses rather than partial ones. To take the illustration of a property insured for 10% of its value, there is vastly more than ten times the likelihood that the company will sustain a total loss than there would be if the assured was carrying insurance up to approximately the value of the property covered.

Another pet argument advanced by people who object to the co-insurance clause is, for illustration, "Why, I am perfectly willing to carry half my risk myself." After many years of experience, and many times asking the assured, "Well, in that event, suppose half your risk burns, whose half is it, yours or the insurance company's? His answer invariably has been, "The insurance company's of course." Does it require any very keen logic to show that a position like that absolutely refutes the idea of the assured carrying half of the risk himself. Only would such a defined position on his part be lived up to if he were ready to agree that half of every loss sustained should be born by him, and the other half paid by the insuring company. Were the assured willing, as a general proposition, to have a clause defining such an apportionment as this attached to the policies, I have but little doubt but what the insurance companies would very gladly accede to it, and that the fire waste of the country would be reduced by a very large amount.

The only way to secure a provision of this nature in the policy and to oblige the assured to live up to an agreement to carry part of his risk himself in fact as well as in name, is to so draft the contract that for a certain consideration granted by the insuring company, the assured agrees to carry insurance to an amount bearing a certain fixed relation to the value of the property insured under the policy at the time of the fire. This means that the insured becomes an insurer of his own property in case he has not taken out sufficient insurance to reach the proportion of his sound value called for by the contract; in other words, he becomes a "co-insurer."

The consideration granted by the insuring company for the attachment of a clause warranting this condition, is a material reduction in the rate. Hence, all co-insurance or reduced rate clauses commence with the words, "In consideration of the reduced rate at which this policy is written."

Then follows the reason why this reduced rate is granted stated in these words, "It is expressly stipulated and made a part of this contract that in event of loss this company shall be liable for no greater proportion thereof than the amount

hereby insured bears to — per cent. of the actual value of the property described herein at the time when such loss shall happen. This you note is practically an agreement or warrant on the part of the assured to carry the specified proportion of the value of his property in insurance. But it does not stop there, for it further stipulates that only such proportion of his loss as is represented by the ratio existing between the amount of insurance carried by any company and this specified percentage of the value of the insured property can be collected from that company. The working of this ratio is to call for a total contribution by the insuring companies whenever there is short insurance and a loss greater than the specified per cent. of the property value. The operation of the clause is not altered, but no saving is effected by its attachment.

The 5% Provision of the Co-insurance Clause.

The final provision of the co-insurance clause is one that is often misinterpreted. I refer to the so-called 5% item. The portion of the clause regarding this reads: "If the aggregate claim for any loss shall not exceed 5% of such actual value no special inventory or appraisement of the undamaged property shall be required."

Frequently inexperienced adjusters interpret this as meaning that with losses of less than 5% of the actual sound value, this phrase will waive the main provision of the co-insurance clause, that which makes the insured a contributor to his own loss if he is short of the required percentage of insurance. This is not so, the clause clearly makes no waiver of this sort and a 1% or a 5% loss is as fully subject to the working of the clause as one of greater amount. Its object is simply to do away with the requiring of a detailed inventory or appraisement in case of very small claims which might otherwise be required.

The Blind and Expensive Attitude of State Governments.

It would seem singular, were it not for the fact that state legislatures have over and over again, evidenced their inability to understand insurance problems, that certain of the states, absolutely prohibit any policy of insurance covering property in such state which shall contain any provision requiring the assured to take out any specified amount of insurance with respect to the value of his property, or that shall render him liable by co-insurance in the event of his not taking out a sufficient amount of insurance. Such action on the part of any state necessarily increases the cost of insurance to the people of the state.

The Reason for Co-insurance.

Now what are some of the real reasons why the co-insurance clause is such an essential factor in the business? It is absolutely necessary that underwriters should have a sufficient amount of insurance with respect to the value of the property covered, to avoid the continual payment of what are in reality only damages, or partial losses, but which in effect owing to short insurance, would become total losses. On no other basis than that of a fixed relation between insurance carried and the sound value of the property insured is it possible for the cost of insurance, or that is, the rate, to be determined with any fair amount of accuracy. It would be obviously unjust to a man who was carrying insurance to the extent of 90% or 100% of the value of his property to ask him to pay the same price per dollar for such insurance, as his neighbor, the owner of precisely identical property both in value and physical condition, but who only carried half as much insurance, since the risk to the companies in the former case, is reduced over one-half from what it is in the latter.

It is just as essential, in order to properly assess the cost of insurance, that is, to fix the tax or rate that the companies must receive in order to collect funds sufficient to carry on their business, that the relation of insurance to value should be considered as well as that the various physical features of the insured property that enter into the original making up of the rate. We all know by experience, that a low rate with a proper co-insurance clause, is in the long run more profitable than a materially higher rate and absence of the co-insurance clause and a consequent light carrying of insurance.

It has often seemed to me, that the opponents of the co-insurance principle were men who, to put it plainly, were prepared to kick because they didn't receive something that they hadn't paid for. Really, this crude description sums it all up. Objectors to co-insurance are mainly men who saw fit to carry a part of the risk themselves, as they were pleased to term it, up to the time when a loss occurred, then they immediately abandon the idea that they are in any way responsible and insist that the insuring company should pay them for something that they had not bargained for, in the first place. From any point of view the co-insurance principle is a right one, not only from the standpoint of the insurance companies, since it defends them from an excessive number of total losses and enables them to determine more accurately the cost price of their commodity, but the fair minded policyholder should also regard it as a friendly clause; friendly to his interest, since it works distinctly against the speculative and avaricious claimant, whose action causes an added burden for the insurance companies and thereby increases the cost price of insurance to the community as a whole.

Comments on the Co-insurance Principle.

It is intersting to note the way in which the co-insurance principle appears to educated men who have had no actual experience in the insurance business, since it brings out an unbiased, logical presentation of the situation. I am glad to take this opportunity to quote from several short essays that were written by members of the fire insurance class in the graduate school of business administration of Harvard University during recent years. These extracts are from five different essays that were presented on the co-insurance clause. They are not presented in full, but the more important portions of them are as follows:

"The Co-Insurance principle is absolutely necessary to secure justice between property owners, and to enable the company to collect premiums from all commensurate with the risk assumed. It is a well known fact that in cities with good fire protection only about one out of every twenty-five fire losses is a total one, many of the remaining losses being only nominal in amount.

"The Co-Insurance Clause provides that every property owner shall have his losses paid only in the proportion that he is willing to pay premium.

"Fire insurance is a tax paid by all the property owners of the community for the purpose of indemnifying unfortunate losers. In form it resembles a general property tax, except that it is collected and disbursed by private companies instead of by the government. As the government tax, to be equitable is paid by the owners of property in proportion to the value of the same, so the fire insurance tax, to be equitable should also be based upon the value of the property owned.

"The Co-Insurance Clause protects the small property owners against the efforts of the great industrial and mercantile corporations to shirk the payment of their just share of premiums. In most large mercantile plants the property is so situated in different localities each separate from the other or by fireproof walls that in a great majority of cases, the fire can be easily confined and under such circumstances a total loss is hardly to be expected. Therefore the large concerns could protect themselves against fire loss by insuring a portion of their value, while a small concern would have to insure for nearly full value for equal protection. The only argument I can see against the use of the Co-Insurance Clause is that a property owner insuring for a small percentage of his value may claim that in event of total loss he is taking a large proportion of the risk himself and therefore in event of a small loss should be paid in full. If his property was so situated that in event of a fire the entire property would be seriously endangered a claim like this would be just and there is no doubt but what the moral hazard would be O. K. as the owner would naturally take all precautions to guard against possible loss.

"Fire insurance is a tax and like all taxes should be assessed in proportion to the value of the property protected by it. The absence of co-insurance makes it possible for the large corporations and the property owner who wants to keep a small insurance to take advantage of the small property owner who will not take the risk of only partly insuring his property. Experience has shown that the fire loss averages around 60 per cent. of the premiums collected, and those premiums must be collected if the insurance company is to do business. If the large corporations will not pay them, the obligation falls upon the scrupulous property owner, which is manifestly unfair. The co-insurance clause (New York policy) provides that the company shall not be liable for a greater pro-

portion of loss than the amount of the insurance bears to the per cent. of actual value of the property. Most of the losses are comparatively small in amount, not being over $100 or $200. Without co-insurance people would only take insurance to a small amount, the companies would have to pay all losses in full and many would be forced to the wall. For instance: two people each own buildings worth $10,000 one insuring for $8,000 and the other for $2,000 the rate being the same in both cases. If each suffers a loss of $2,000 they are both paid, but one has been taxed four times as much as the other, and has received no more. Thus it is seen that co-insurance protects the interests of the man who is unwilling to take the risk of partial insurance. In the case mentioned, the man insuring for $2,000 should be allowed to collect only one-fourth of his loss or $500.

"The owner of property is not, however, always obliged to carry 80% insurance. He may carry less, but he must pay a higher graded premium. Co-Insurance also decreases the moral hazard.

"The only objections that can be raised against Co-Insurance are that it puts an obligation on the insurer to carry a certain amount of insurance, and where the 80% Co-Insurance Clause is the practice, it makes it impossible for the property owner to secure full indemnity in case of complete loss. The first of these objections has been practically removed by the graded premium. The second will appeal chiefly to unscrupulous property owners."

"The foremost argument in favor of the adoption of the Co-Insurance Clause is that it is in accordance with the law of average which is the basic principle of insurance. If the principle were adopted that every one must insure his property to a certain proportion of its actual cash value or receive in case of loss only such proportion of the loss as the amount insured bears to the full value of the property, then the ratio of losses to amounts written or to premiums in a certain class would be a reliable basis from which an average rate would be justly and correctly arranged. No one assured would receive any greater protection for each dollar of value assured than any other. Yet under the present conditions, that is where the Co-Insurance Clause is in only partial use; the losses in its absence are in larger proportion to premiums and values insured and the cost of insurance is increased to those who carry full or nearly full insurance, whereas the cost is reduced for those who insure but a part of their property and yet get protection up to the full amount insured.

"Manifestly this arrangement of the insurance tax, for it is virtually a tax, is unfair. The cost of insurance is just as much a tax as is that levied by the government on property. And does the government allow the citizen to pay on just what proportion of his total property he desires to? Certainly not.

"Suppose for the sake of illustration, the assessment system of levying taxes were abolished. Now "A" decides to pay taxes on 75% of his property, "B" on 50% and so on. The equality of taxation would be absolutely destroyed and the government could get no idea of how much to make the tax rate in order to raise the necessary funds. And the cause of insurance is, precisely analogous to this.

"Were insurance conducted by the government, it would very quickly be true that losses and expenses would be assessed against the insurance tax payer in precisely the same manner as taxes, that is, upon the full assessed value of property so protected.

"The fact that such an immense corporation as the United States Steel Co. objected to the co-insurance stipulation when it insured in private companies yet when insuring its own property demanded that each plant contribute to the general fund in proportion to the full value of that plant, showed that they recognized clearly the principle of Co-Insurance and appreciated its value.

"The probable effect of the adoption everywhere of the Co-Insurance principle is also a strong argument in favor of its use.

"In two ways the average rate would be reduced. First, because larger sums would be paid the companies for premiums and thus the average loss rate would be reduced; second, because in many cases the liability of the companies would be reduced."

"To my mind the arguments in favor of "Co-Insurance" clauses are far more convincing than those against it. Personally, I believe the "Co-Insurance" or "Reduced Rate" Clause to be a benefit to the community at large. These are my reasons. In a previous lecture we learned that the "Loss Cost" of an insurance company is the amount that burns for every $100 insured; or better, it is the ratio between the amount burned and the amount insured. In the same lecture we learned that the "Loss Ratio" of an insurance company is the ratio between the losses incurred and the premiums received. Now it is not difficult for one looking at the "Co-Insurance" Clause to realize that if it were strictly lived up to, both the "Loss Cost" and the "Loss Ratio" of the insurance companies would tend to diminish, because the companies would be writing larger policies, thereby receiving larger premiums and consequently the ratios would be smaller. This will be clearer when we realize that insurance losses are governed by the law of average. It is not logic to maintain that the amount of losses in a community increase proportionately with the gross amount of insurance written in that community. Therefore, since the basis of the premium rates is determined from the average loss cost of the different classes of risk, the rates for insurance would tend to be lower and the insuring public would in the long run be the benefiting party of this insurance contract."

You will note that the view-point taken by the writers of the papers just quoted is in several instances strikingly original, but none the less logical and convincing.

The Operation of the Co-insurance Clause.

I have assumed that you all know the phraseology and the working of co-insurance clause so fully that it is not necessary for us to dwell on either of those points at this time. The term "full co-insurance" is used where 100% is carried, that is where the total insurance is practically the same as the value of the property insured. Percentage co-insurance clauses, usually either 80% or 90% mean that the insurance carried is agreed to be either 80% or 90% of the sound value of the insured property. The operation of this clause in the event of loss is more a matter of loss adjustment and apportionment, than of a discussion of the clause itself.

Where properties are under good public protection and in consequence there is a less chance of total losses resulting, the presence of a co-insurance clause is of the greatest importance. Where properties are entirely outside of protection, and where losses are nearly all total, it is not, of course, as important a matter since the operation of the clause in the event of a total loss always gives the claimant the face of the policy unless same exceeds the loss sustained.

With sprinklered risks where the vast preponderance of the losses are of relatively small amounts when contrasted with the total insurance involved, owing to the loss reducing effect of the sprinkler system, a higher percentage of insurance

with respect to value is essential and therefore, a clause guaranteeing 90% or even 100% of the sound value is almost invariably issued.

Guaranteed Amounts in Lieu of Co-insurance.

In some cases, a guaranteed amount of insurance is specified by a clause attached to the policies in place of a percentage amount. There are reasons both for and against this practice. Its favorable features are especially apparent to the assured, since it reduces materially the element of doubt as to what the actual value of the insured property will be considered. You will note that we say "reduces" this element of doubt. It does not entirely remove it as is often assumed to be the case. If at the time of a loss, it were found that the property was actually of less value than the guaranteed amount of insurance, a sum in excess of this actual value would be no more collectible with a guaranteed amount of insurance than would be secured under the operation of the co-insurance clause itself. Guaranteed amounts of insurance do not make the policy a "valued" contract. The objections to using this clause are fluctuations in value and also the fact that it can only be admissible where a formal appraisal by disinterested and competent experts has been made in order to determine the sound value of the property and from that, to fix the "guaranteed" amount of insurance that shall be carried. There is always difficulty and expense attendant upon the securing of dependable estimates of this sort, and as we have just stated, the appreciation or depreciation of property that time is sure to bring about especially if the appraisal is one of many years standing, will result in leaving the assured either short of needed insurance or have caused him to be at the expense of carrying more than he needed. It is objectionable, too, in that for a possible benefit to the few who have losses, it adds to the cost of insurance to the community as a whole.

Average and Co-insurance Together.

The question is sometimes raised as to what is the effect on a policy where both the average clause and the co-insurance clause are attached, some seeming to think that one does away with the other and that complication is likely to result. Under the conditions of the average clause, the policy becomes specific and the co-insurance clause is as applicable to a specific policy as to one of a blanket or compound nature, the procedure therefore, is make the policy specific according to the provisions of the average clause and then apply the co-insurance clause to these various specific items separately.

Non-concurrencies.

Many of the most embarrassing non-concurrencies that develop in connection with loss settlements are due to the presence of either average or co-insurance clauses, on some of the policies and their absence on others. The questions that arise under this condition are ones that can be more intelligently treated in a discussion of losses and adjustments, but it will not be amiss here to state that it seems very desirable that insurance companies should get together over this and adopt a universal clause to be used on *all* policies stating the procedure to be followed in the event of non-concurrencies, either from the condition such as we have just described or those that arise from other variations in description of property or clause attachments to the policy. Our British brethren have to a large extent done away with this difficulty that we so frequently are forced to confront by adopting what they are pleased to term, the "second condition of average."

PART II

Fire Hazards—Tanneries

BY

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INTRODUCTION.

In considering the so-called *special hazards* from a fire insurance point of view we must use care not to become so absorbed in the interesting processes and particular hazards of the industry as to lose sight of the common every day and general causes of fire.

If we are hiring a man for a particular work we look carefully into his technical or business knowledge and experience as demanded by the position he is to fill, but when it comes to the actual selection of the man the factors which govern the decision are quite likely to be the old fundamentals, industry, honesty, tact, common sense. So in selecting our lines on the industries which we classify as special hazards, while not at all neglecting the details of the arrangement and hazards of the processes, we must finally record our judgment by the consideration of the four fundamentals of fire prevention, *construction*, *occupancy*, *protection* and *exposure*.

Old rating schedules are notoriously rich in charges for particular hazards which came into being through an unfortunate, often limited, experience of some one or two companies in days long past.

If we try to gauge the relative danger of these hazards by a study of the schedule we are quite likely to find that they do not square with the actual fire record. In the particular tannery schedule I have here there is a charge for buffing, if in the main building, of 45 to 55 cents and a charge, under construction, of 10 cents for a shingled roof. The actual fire record in a period of over ten years indicates that these charges more properly could be actually reversed.

Losses in the manufacturing or special hazard risks may be classed in two principal divisions which for lack of better names I shall call *serious losses* and *expected losses*.

Serious losses result from a defect in one or more of the fundamentals, *construction*, *occupancy*, *protection*, *exposure*. Such losses usually govern the profit and loss account on any particular class if written widely for a long period. It matters little

what particular process, or so-called special hazard, of the plant may start a fire, the real cause of a large loss is always either poor construction, poor occupancy, poor protection, an overpowering exposure or a combination of these evils. One such "serious fire" may result in a loss exceeding that of the sum of all the "special hazard" fire losses which the risk might suffer during its entire experience. These facts should be kept in mind in considering the "special hazards" as fire risks. In all our interesting wanderings into the details of manufacturing processes let us ever remember that they are all less important than the big four of fire prevention, *construction, occupancy, protection* and *exposure*.

Expected losses are those resulting from the special hazards; the peculiarly dangerous processes or conditions incident to the particular risk. They are foreseen by both the assured and the underwriter, usually guarded by the assured to such an extent as to safeguard his business against serious interruption and expected by the underwriter to occur, not in such volume as to destroy his estimated profit. Very often these special hazard losses are so small individually as to appear unimportant, yet they recur with such persistent regularity that one is apt to see his anticipated profit literally "go up in smoke," especially if measured against some of the rates now so popular in certain localities. We are fortunate if we have the opportunity of covering such losses by gains from other more profitable classes as is possible in some organizations specializing on industrial risks.

Of course, occasionally there will be large, if not serious, fires under the special hazards where the fundamentals, *construction, occupancy, protection* and *exposure*, do not cause the large loss, as also there will be some small recurring fires where defects in the fundamentals cause the fires and the special hazards are not a factor, but such fires are not the usual type from which general conclusions may be deduced.

The success of the underwriter in writing industrial risks is measured by his skill in estimating the losses under the "expected" fires, the probability of the "serious" fires and the likelihood of the special hazard fire becoming a serious fire. So we study the industries not only to learn the processes and operations conducted within their rooms, but we consider also the habits of the trades, their prejudices, manner of housing, character of employees and management, the attention given to the fire hazards of the business, the protective apparatus and the location and general appearance of the plants.

An underwriter's interests may be assumed to stop with a careful weighing of the relative importance of all these things necessary to judge the risk as a business proposition, yet it is well to study the details of the various industries as occasion permits. They are all extremely interesting and a knowledge

of them cannot fail to result in increasing our efficiency. An agent or broker is particularly able to serve his client if well informed as to the conduct of his factory and an examiner will be able to save much time if he recognizes the processes as reported and does not have to look up the terms and hazards to properly interpret inspection reports.

Our present subject, *Tanneries*, furnishes an especially interesting record relative to the *special hazard* and the *serious* fires. A compilation which I made in 1912, of the National Fire Protection Association fire record shows approximately 50% of all tannery fires as originating from the special hazards, yet unquestionably the real causes of practically all the total and large losses were poor construction and lack of protection. The special hazard fires in nearly all of these cases could have been readily stopped were the ordinary means of protection at hand or had there been no unprotected floor openings or other fundamental defects in construction present to permit the spread of the fire to serious proportions.

The unpleasant aroma of tanneries has some relation to their fire losses, as it has often necessitated their erection in isolated places beyond the reach of public water supplies and fire departments. The unclean conditions usually found in old style tanneries have not encouraged the erection of well constructed buildings, as there need be no rooms crowded with employees and there is little delicate machinery to house.

The replacing of many of the old hand processes by machines, the changes in the character of the labor brought about by the introduction of machinery and the substitution of chemicals for some of the offensive agents formerly essential to tanning are all tending to marked improvements in the construction of tanneries. Health laws and efficiency are working together to eliminate the offensive old style tannery. Tanneries may now be found in cities so built and conducted as to compare favorably with other industrial plants.

Construction.

The unsatisfactory experience of many underwriters in insuring tanneries is largely due to poor construction. The typical old style tannery is so built that its total destruction is practically assured whenever a fire gets a fair start.

The type is a group of rambling wooden buildings of very light construction with steep roofs covered with wooden shingles, the main building often six or seven stories high, often with the walls of the upper stories equipped with louvers, or open sides, and around this central building a miscellaneous lot of extensions and additions, mostly one story high, the whole being usually in need of general repairs, saturated with grease and without sign of fire walls or protection for vertical openings.

There is little hope for such a tannery, and were it mothering hazards of twice the usual severity, they would be unimportant relatively to the overpowering defective construction.

Many tanneries have the floors of the upper stories slatted as well as the open walls, to permit air to circulate through the rooms to dry the leather which they contain. The posts of the buildings are usually very light, and if the building is fully stocked with heavy leather, overloading the structure to a dangerous degree as is often found, we may form some conception of the catastrophe which follows a fire in such a structure.

Over 50% of all serious tannery losses have been due to the rapid destruction, made possible by the type of building described.

Protection.

Second in importance to poor construction is lack of protection which has resulted in the destruction of about 25% of the tanneries where serious losses have occurred. It is surprising to find in the fire record tanneries having a value of over $100,000 which were destroyed because they lacked even the simplest means of fire protection. In one case not even fire pails were available. The fires forming this group were such as could easily have been controlled by ordinary means of protection.

The remaining 25% of large tannery losses is chargeable to lack of alarm service. These valuable tanneries were left without care, no watchman or other means for transmitting a fire alarm to summon aid. It seems inconceivable that properties of such value are left without guarding, nights and Sundays. The fires in this group were so extensive when discovered that the destruction of the plant was assured, regardless of any virtues it might possess in the form of good construction or of fire protection.

I have purposely put off the discussion of the processes and hazards of tanneries in order that the great importance of construction and protection, for this class of risk, might be emphasized and be borne in mind through all the remarks which may follow. The class has been unique in its many instances of apparent disregard of ordinary precautions in guarding large values by proper housing and adequate fire protection. General improvements in the class and the more acute sense of appreciation of values which shows signs of appearing in our people without doubt are tending toward a more favorable record for the tanneries of the future.

Tanning is the art of preserving the skins of animals in the useful and convenient form known as leather.

A pelt fresh from an animal contains hair, which except for some special uses, must be removed, and also animal matter which, if allowed to remain will either putrefy and ruin the skin or will dry hard, making the skin stiff and horny and so unfitted for use. The tanner removes the hair, destroys the animal tissues surrounding the fibres and improves the fabric by filling the fibre spaces with oils or other preservatives and finishes one surface of the skin, according to the particular uses to which the leather is to be put, by coloring and polishing.

These objects necessitate certain departments in the tannery, aside from such terms as store house, finishing room, etc., which are common to most all our manufactories, which need defining for those to whom their names are unfamiliar.

The "beam house" is the part of the plant where the preliminary work on the pelts is done, the dehairing and its aecompanying processes. This is usually a one-story building adjoining the main building.

The "tan yard" is usually a one-story shed, the entire floor of which is mostly all occupied by tan vats, square wooden or concrete tubs which contain the tanning liquor and the skins undergoing the tanning process. Many modern tanneries do not have tan yards, but tan the skins in large revolving tubs or wheels, usually located in the first story of the main building.

"*Dry lofts*" are the rooms usually comprising the upper stories of the main building and contain the leather, hung on hooks or tacked on boards, to dry.

The finishing processes are usually located in the main building in the stories below the dry lofts.

Raw Stock. Tanneries are generally placed in one of two classes, hide, or heavy leather tanneries, or skin or light leather tanneries.

Hides are the pelts of large mature animals, such as horses, cattle, camels, and walruses. Heavy leather, such as is used in shoe soles and belting, is produced from hides.

Splits are split hides. Some heavy hides have been split apart into five separate pieces, each the full size of the hide. Leather for shoe uppers, bags, carriage tops, furniture, etc., is produced largely from splits.

Kips are undersized hides. Hides, kips and splits are found in heavy leather tanneries.

Skins are the pelts of small animals, such as calves, sheep, lambs, goats, kids, etc. They are made into leather for shoe uppers, pocket books, book bindings, gloves, fancy articles, upholstering, etc. Pelts are shipped in three forms, green, salted or dryed.

Green Hides are hides fresh from the carcass and are untreated.

Salted Hides are those with salt rubbed over the flesh side. They are usually folded and tied up, fur side out.

Dryed Skins are hard, wrinkled and stiff, having been dried without treatment.

Pickled Skins may be the stock of a part process tannery. They are skins which have been dehaired and soaked in an acid bath. They are very sensitive to damage by water.

A Hide Tannery is usually considered as producing sole leather, belting, etc.

A Chrome Tannery produces light leather by the so-called chrome process.

An Extract Tannery is one using certain extracts as a tanning medium.

A Bark Tannery uses oak or other bark as a tanning agent.

A Morocco Shop is a tannery making kid from goat skins.

Processes.

An animal's skin has a thin outer portion or layer, the epidermis, containing the hair sacks, sweat glands, etc. This part of the skin cannot be formed into leather and must be entirely removed in the preparatory processes.

The corium, the true skin, is the portion used for leather. It forms the bulk of the pelt and is separated from the epidermis by a thin membrane which forms the so-called grain of the leather. Splits having the grain are much more valuable than those from the flesh side of a hide.

The corium consists of bundles of fibres interlaced and surrounded by a softer substance which is removed in tanning. The tissues fastening the skin to the body contain fat cells and are removed in the process called "fleshing". Care is taken in removing the epidermis to not injure the grain.

Hides are thicker on the neck and butts than on the sides and bellies. The value of hides and skins varies with the breed, feed and health of the animal, the climate in which it was raised and the freedom of the pelt from injuries from sores, cuts and bruises.

Large quantities of water are required by tanneries. Soft water is essential to good work. It is sometimes softened artificially.

Soaking. The first process is soaking. Green hides are soaked to remove blood and dirt, salted hides to remove the salt and dried hides to soften them.

Salt and foreign matter interfere with future processes and blood and other animal matter may cause fermentation if not removed, and they interfere with the action of the tanning agents.

Cold water is used for soaking, which is done in vats where the pelts may remain several days. When removed from the soaks the pelts are trimmed with a knife, tails, ears, animal matter and other irregularities being then removed.

Dehairing (*Depilation*). Unless it is desired to tan the skin with the hair on, the second process is dehairing. This may be done in two ways:

1. *By Putrefaction*, called sweating. This is the older process, still in use for sole and some other heavy leathers. The skins are put in warm, closed, damp rooms, where they decay only sufficiently to permit the ready removal of the hair. These skins are usually given an acid bath afterward, as the process tends to weaken them.

2. *Liming.* Pelts are placed in vats containing milk of lime (slacked lime and water) and worked daily for three to fifteen days. About one pound of lime is used to ten pounds of pelt. Liming loosens the hair and epidermis, swells the corium and dissolves the tissues surrounding the fibres.

For high grade leathers, where a fine grain and softness are essential a small amount of sulphide of arsenic (As_2S_2) is added to the lime liquor.

Where injury to the hair is not important sodium sulphide will hasten liming. This is used much on goat skins.

Liming is sometimes hastened by keeping the skins in motion by paddle wheels working in the vats.

The milk of lime is prepared by slacking quick lime. This work should be done outside or in a detached shed, if done extensively. Some tanners make up a batch of slacked lime in advance sufficient for several weeks' supply.

In most tanneries the dialy supply of lime is brought to the factory each day. Quick lime in storage constitutes a well known hazard. If it becomes wet it will heat sufficiently to set fire to its wooden containers and any nearby combustibles. It should be stored in a detached shed and the shed should have watertight roof and walls. The floor should also be above grade to insure dryness.

Beaming. The pelts are removed from the lime pits and thrown over a wooden horse for drainage.

If beamed by hand they are then spread on the beam (an inclined bench with a curved surface), hair side up, where the hair is scraped off by a large blunt edged knife held by handles at each end.

Unhairing machines are now much in use. They consist mainly of a revolving cylinder whose surface is a series of knife edges set inclined both ways from the centre of the cylinder. so as to tend to spread and stretch out the skin as it is shaved. The skin is held against the knives by a pressure plate or cylinder.

Slating is additional beaming by hand on a slate, marble or other smooth surface to more thoroughly complete the process. It is not found in all tanneries, but usually follows machine beaming.

Fleshing is the process of removing flesh, fat, etc., from the flesh side of the pelt. It may precede or follow dehairing. If done by hand a sharp double-edged knife is used. The fleshing machine is similar in its action to the dehairing machine.

Bating — Puering. If the lime action is allowed to continue the skin would be spoiled and the tanning process interrupted.

To counteract the lime and make soft the skin, which has been swollen and stiffened by the lime, the skins are placed in vats containing weak solutions of pigeon or hen manure.

Puering is the same process, except dog manure is substituted. This is used in producing fine and light leathers, kid, morocco, glove leather, etc.

The skins are kept in the baths only a few hours. It leaves them alkaline, as they contain ammonia and lime.

In working calf and some other skins, "drenching" follows or is used as a substitute for bating. This entirely removes the lime and leaves the skin plump and the fibres open, ready for tanning.

The drench liquor is prepared by fermenting bran in warm water, which forms lactic and acetic acids. The skins are usually left in the baths over night and worked during the night to keep them submerged. This process makes soft leather. It is not used for belting, soles, harness leather, etc.

Splitting. Thick hides are often split into two or more layers, thus in a way making one hide double or triple itself. The layer having the grain or hair side is the best piece, the other layers, called "splits," making an inferior leather.

Hides may be split when taken from the liming vats or split later after tanning.

Splitting machines consist mainly of a rapidly travelling steel band knife, sharpened continuously by an emery wheel. A suitable table, gauge plate and rollers guide the hide against the knife. The machines are very skilfully made and they can be adjusted to take off a split as thin as $\frac{1}{16}$ of an inch.

The emery wheel operating on the rapidly moving knife gives off a shower of sparks. It should be and usually is enclosed in a metal box with a fan to take the dust away.

In splitting dry hides there is an inflammable leather dust given off which constitutes a hazard as the dust may ignite from the sparks.

Pickling. The skins are worked usually in wheels in a solution of salt and sulphuric acid or for some leathers lactic, formic, or boric acid, ammonium chloride, etc.

Pickling is more or less of a substitute for the bacterial bates and produces a leather less soft than the latter.

Pickled skins, especially pickled sheep skins, are often the raw product of some tanneries which do not conduct a beam house. They are quite susceptible to damage by fresh water, for unless they can be promptly handled spots will develop in the leather wherever the pickle has been disturbed by fresh water. The location of the pickled skin storage is quite important to the underwriter. It preferably should be outside or in some building where the occupancy in floors above is not likely to give cause for the operation of sprinklers or fire streams.

Degreasing. In sheep and pigskin tanneries degreasing is often found. These skins contain much oil, and usually after pickling they are degreased. This is done by hydraulic or steam presses. A large number of skins are packed into the press, sometimes in press cloths or between boards, and a high pressure applied. The grease is collected in pans at the bottom.

Press rooms are necessarily very oily, and, where used, the care of the press cloths is most important. When washed they should be dried in metal dryers or in a well-protected room having all steam pipes guarded by screens.

Naptha degreasing is a separate industry not usually found in tanneries. It is a very hazardous process and should not be permitted in or near other buildings.

With the completion of the processes to this point the hides or skins are ready for tanning. There will be found individual cases where the work is carried on differently than described and a quite radical departure from them may be occasionally discovered, but in general the preliminary or beam house processes of the average tannery will be found about as pointed out.

Practically all these processes are wet and in general fires are unlikely to occur where they are conducted. There have been, however, many fires starting in these wet rooms, some from quicklime, workmen's overalls on steam pipes, smoking, electrical apparatus, repair work, hot bearings, rubbish, etc.

Occasionally a hair dryer will be found in a tannery, but as a rule the hair and other by-products are promptly removed, being worked into marketable products by other concerns. Hair is dryed just as textiles are dryed in our woolen mills, either by mechanical dryers or on screens called "table" dryers. In either case steam pipes are used. The old dryers are built of wood, but the newer ones are of metal. All bearings for the fan and movable apron should be of the self-oiling type and be outside the walls of the dryer. All dryers should be equipped with sprinklers.

The moisture, acid and ammonia fumes of the beam house processes cause much corrosion. Especial care is required to guard the electrical equipment. Wiring should be preferably of open knob construction with rubber insulation.

All refuse from the beam house processes should be promptly removed to a safe place. Hair, pieces of pelt, fleshings, animal bates, etc., may heat up to a dangerous temperature if allowed to accumulate, especially if mixed with other organic refuse. Limed hair and fleshings are especially subject to heating and should be removed daily.

Tanning. In a manner somewhat similar to the action of dyes on the textile fibres, but of a nature not yet fully understood, certain reagents act on the fibres of the corium to change their character and preserve them in the form known as leather. These active agents are tannic acid, several metallic oxides (such as cromium, alumina and iron, (oxidized fats or oils, insoluble metallic soaps (stearic acid, etc., with lead oxide) picric acid, pinic acid, etc., with new ones added from time to time with the advancement of the art.

Tanning was formerly conducted solely by the use of vegetable products containing tannic acid and these were few, but now a great variety of both vegetable and mineral tanning agents are employed permitting the tanners to vary their product considerably. A great variety of leathers is now produced, good, bad and indifferent, adaptable to many purposes. Some leathers, beautiful in their coloring and softness, are produced by the new chemicals. The art has made great progress and changes are continually under way which call for careful watchfulness on the part of the underwriter. Changes in chemicals and methods may mean the introduction of new hazards at any time. I shall mention later some which quite lately have been introduced.

The Vegetable Tannins are infusions or extracts from the bark of the oak, hemlock, willow, chestnut and other barks, quebracho, gambier, sumac and others of lesser importance.

Ground oak bark was used in the old style tannery very extensively, and it still produces the best sole and belt leather. It gives a light colored leather. Oak tans very slowly.

Hemlock, strictly a variety of fir, gives a red colored leather which is commonly seen in sole leather and belting. Willow is not much used. It gives a yellow color.

Quebracho is very extensively used on both hides and sheep skins. Quebracho comes in sacks in the form of a hard gum.

Sumac is a yellow powder used extensively on sheep skins and often on goat skins (kid).

Some of the vegetable tanning materials in lesser use are elm, beech, horse chestnut, acacia, divi-divi, nut-galls, valonia, myra-bolams and palmetto.

The tanning liquors are made by adding the vegetable extracts to water to the required strength. Bark liquors are obtained by leeching, which will be later mentioned.

The mineral tanning agents are salts of aluminum, chromium, sodium, zinc, manganese, etc.

The most important of these is the salt of chromium (potassium di-chromate), from which we get the term *Chrome Tanning.*

This process is used for splits, kips, calfskins, sheepskins, skivers, kid, and such skins for light leather. Chrome tanned leather is a greenish blue color before dyeing. Some belting is chrome tanned and it is sold for use in wet places. Of late we have seen chrome tanned shoe soles in use quite a little.

Alum tanning (sulphate of aluminum and common salt) is the next in importance to chrome tanning. It is used to produce white and other light colored leathers from both hides and sheep skins and for kid.

Oil Tanning is the oldest form of tanning on record. It is more of a preserving means than a strict tanning, and with alum tanning and some other salts, should more accurately be called "tawing" than tanning. The former term is little used, however, all processes of producing leather being generally called tanning.

Oil tanned leather is represented by chamois, buff, some "ooze" leather, "buckskin," etc. Chamois, so-called, is the flesh side of a split sheep skin or skiver.

Cod oil is practically the only oil now used, although oil tanning can be done by some animal oils.. The skins, after a very thorough bating, are milled in the cod oil which surrounds and preserves the fibres. Mills similar to fulling mills used in woolen finishing are used for this purpose. An oxidation takes place also in the goods, a temperature of over 150° being reached, after which the cod oil and natural oil of the skin is expressed. This bi-product is known as *Degras* and is used for currying and dressing heavy leathers.

The presence of the fish oil and the oxidization process constitute a fire hazard necessitating strict cleanliness to insure safety against fires from spontaneous ignition where oil tanning is conducted.

The real tannins have a permanent effect on the leather. They have the properties of becoming precipitated upon and into the fibres in the tanning process. The tawed leathers are not so permanent, and washing destroys the result of the process more or less.

Bark Extract Preparing. Most of the tanneries receive the bark extracts ready for use. What we know as the "bark" tannery makes its own liquor from the raw bark, which is often stored in large piles in the yard, but usually kept covered.

There is a marked increase of hazard in the bark tannery over the extract and chrome tannery owing to the processes necessary to grind the bark, conveying the ground bark to the leach tanks and caring for the spent bark and refuse, which is usually burned at the boilers.

The bark mill consists of a rapidly revolving steel disk fitted with knives which cut the bark into small bits. The creation of dust is a loss to the mill, but cannot be wholly avoided, so the hazard of dust explosions is present as well as those incident to the rapidly revolving grinder subject to contact with foreign matter entering with the bark and to the breakage of its own knives and parts. The more modern mills are made entirely of steel, as are also the hoppers, conveyors, etc., but the older tanneries have wooden mills with wooden appurtenances.

The bark mill is such a source of danger to the main buildings that it always should be in a detached building or cut off in a standard manner. All hoppers and conveyors should be of steel and the refuse kept removed as much as possible from the bark mill room.

Hot bearings have started some fires. The mill should have grease cups, or self-oiling bearings, preferably both.

Some bark mills have a horizontal disk, their driving shaft being vertical. The step at the bottom of this shaft is a source of danger and its oiling should be thoroughly safeguarded. Such mills should be elevated on a platform so the step will not be below the floor, where it may become surrounded by chips and dust.

On account of the dusty conditions surrounding the bark mill no open lamps should be allowed and all lamps should be well guarded. Bark grinding can be conducted in the daytime and in a well arranged mill room there would be no great necessity for any artificial light.

A fan and cyclone separator should be used to collect the dust. Some of the older mills have steam jets to lay the dust.

Leaching. The leach house is usually a large, roughly constructed building to contain the large wooden vats or leach tubs. There is no hazard to the process except steam pipes which are used to heat the liquor slightly.

Leaching consists of soaking the bark chips in water. The tannic acid of the bark is soluble in water.

There is danger of conveying fire from the bark mill to the leaching building by means of the bark conveyor. The safest method of conveying the bark is to float it on water into the tubs. Screw, belt, chain and pneumatic conveyors also are used.

Conveyors, if of wood, should have open tops. Spent bark conveyors to the boiler house are equally dangerous with the bark mill conveyor.

Spent bark is sometimes pressed in a mill having steel rollers to recover all the extract and make the spent bark dryer so it may be utilized at once for fuel.

If not expressed the spent bark is usually conveyed wet to the boiler house, where it is allowed to stand in a large pile to dry out. As it becomes dry it is fed to the boilers.

Boiler Houses.

Many fires result from the boiler fires and stack; about 20% of all. Such fires are especially prolific in bark tanneries. The fire spreads back from the boiler furnace to the large pile of spent bark usually kept in the boiler room, runs over the pile, often extending to the roof and into the conveyor, which serves to transmit the fire to the main buildings. Or, in burning the spent bark, the sparks from the stack, which are almost unavoidable, fall on the shingle roofs.

Spark arresters help, but are hard to maintain. The shingle roof should be replaced with a spark resisting covering. Boiler flues and chimneys should be kept clean. A very bad fire record has resulted from both these causes.

The Dutch oven type of boiler furnace is probably the safest for this work. The boiler house in bark tanneries should preferably be of fireproof construction, or at least well detached.

For an extract tannery burning coal an ordinary cut off power plant is safe. The power required to operate the tannery is comparatively light, but is increasing rapidly as machines replace the old hand processes.

Tanning.

Three methods are employed in tanning:

1. Suspension in vats.
2. Stirring with paddle wheels.
3. Tumbling in mills or "pin" wheels.

1. The first, suspension in vats, is the process mostly used in bark tanneries and extract tanneries where the heavy leathers are produced. It necessitates the tan yard, usually a one-story shed-like structure of large area, the floor of which is mostly occupied by vats, usually built of planks. They are five or six feet deep, and vary in size with the hides being treated. The hides are usually hung over sticks, which suspend them side by side, the vat being filled with the tanning liquor over the tops of the sticks. This is a slow process, varying with the tanning agents used, the thickness and kind of hide. The vats when filled are floored over with loose planks to facilitate the working at adjoining vats. The location of tan vats in the main building is an occupancy defect. Separate tan yards are better.

The spoiling of tan liquors in tan vats by diluting with hose stream or sprinkler water or by soiling from the debris of a fire has often resulted in a large loss. This is espeially important in use and occupancy insurance.

The continuity of the entire processes in the tannery can be interrupted seriously by the spoiling of the tan liquors. If tan vats are located below hazardous rooms the water used on minor fires in these places is apt to get into the vats with unnecessary loss.

The hide from the beam house is first treated with weakened (partly spent) liquor, but as the tanning continues the stock is moved to vats containing stronger tanning liquor. In some cases the liquor is changed by pumping, the hides remaining in the original vat. For heavy leather the final tanning is often accomplished by packing the hides horizontally with a layer of ground bark between each, the whole being covered with strong tan liquor.

When thoroughly tanned the hides are removed from the vats and "scoured" usually by a machine, which scrubs them while water is applied.

2. The second method, the use of paddle wheels, is used mostly for goat skins in so-called morocco shops, but other light skins, sheep or calf, are sometimes so treated. The tanning liquor and skins are placed in vats or tubs, over which paddle wheels are mounted and rotated to continually stir the skins and liquor.

3. The third method, placing the skins and tanning liquor together in rotating mills, is most extensively used and for all work, except in producing the very heavy leathers.

Chrome tanning is conducted usually by mills, but paddles are generally used for chrome tanned kid. The dichromate of either potassium or sodium is the important chemical used. The skins are milled in the tanning solution.

There are slightly varying methods of conducting the chrome process. Some tanners use two baths, and if so the skins appear yellow after the first treatment. They are drained of the surplus liquor or worked on a "putting out" machine before being returned to the second bath, from which they emerge with the characteristic blue-green color of all chrome tanned leather.

In the two-bath process hydrochloric acid is used; in the one-bath process the acid is sulphuric. Both acids may be found in chrome tanneries and their storage constitutes a hazard.

After tanning the skins are allowed to rest, to set the tan, this being sometimes done by working the skin on "setting" machines. Bicarbonate of soda is used to neutralize the acid, after which the skins are washed and hung up or tacked on boards to dry.

Drying.

Skins are dryed by being hung on hooks flat, as are clothes on a line, or they may be tacked on boards. The latter method is called boarding. It stretches the leather as it dries and is

more often connected with the later finishing process. The upper stories of the main buildings of a tannery are usually used as dry lofts.

Skins may be dried by the atmosphere, in which case the sides of the dry rooms are equipped with louvers to regulate the circulation of air through the skins. It is extremely difficult to stop a fire in these rooms so open to the wind. It is only by chance that sprinklers in such rooms can show their usual efficiency.

Steam heated dry lofts are those heated by steam pipes. The pipes are usually placed in banks at the ends of the rooms and possibly also at the center.

Usually the hot air is circulated by fans, which are placed in the opposite wall from the steam coils and discharge the moisture-laden air outside the building. In some cases, to the further consternation of the fire underwriter, there are large floor openings under the steam coils and at other places, through which the air is circulated by fans or gravity, among the several floors. This is an extremely poor arrangement. Some openings may be protected by trap doors arranged with fusible links and the fans may be arranged to be stopped automatically in case of fire, but such means are more or less futile.

The safest dry lofts are those where the floors are tight and shut off properly from the others, and each room equipped with separate steam coils and with a separate fan at the opposite end.

Drying by a hot air system from a central plant is but seldom found. If used, all flues should be of metal and, if possible, the use of fans avoided.

Alum and sumac-tanned skins are usually air dried. Heat is generally used for crome and extract tanned skins.

FINISHING.

There is much variety in the processes of finishing leather dependent on the particular uses for which it is made. Tanning in general is simply a fibre-preserving means, and skins left without further treatment would be coarse, stiff and ill-adapted to most uses required of leather. Finishing softens, stretches and sets the leather, makes its thickness uniform and gives it the particular color and style of surface finish desired.

When light colored leathers are desired and uniformity in shade is important skins are retanned. This process consists of bleaching or removing or "stripping" the surface tannage from the skins by weak alkalis, after which they are retanned with a light colored tanning agent such as sumac.

Stuffing, oiling, fat liquoring are the processes used in surrounding the tanned fibres with oils to lubricate them and make the leather soft and pliable and also to add body and

weight. Heavy leather is stuffed with tallow, degras, fish oil or other heavy oils and in the old style tanneries is largely done by hand.

The light leathers are fat liquored by neatsfoot, castor or paraffine oil or by some of the sulphonated oils now used extensively. After stuffing, heavy leather is often hung up to season and the floors of the rooms become exceedingly oil soaked. The old style curry shop is quite generally oil soaked throughout. Drip pans or beds of sand should be placed under all oiled leather likely to drip.

Stuffiing is done by rubbing in the grease by hand with the hide spread out on a slab, or, as is now more common, by milling in a wheel. The fat liquors are added from time to time, while the wheel is in motion and steam or hot air is also passed into the drum to aid the oil to permeate the skin. The temperature seldom exceeds 150°.

Setting, putting out, stretching, slicking, stoning are all finishing processes to remove excess grease and water and to bring the leather to a fixed and permanent form.

Stretching is usually done by drying the skins while tacked on boards in addition to the use of machines for that purpose.

Slicking and stoning are surface finishing processes, the stoning being to smooth the rough fibres of the flesh side.

Skiving is reducing the leather to uniform thickness by cutting thin "skivings" from the flesh side. It is a process somewhat like splitting. Sparks from the emery wheel which sharpens the cutter may get into the skiving or leather dust and later cause a fire.

Shaving is similar to skiving, but produces finer waste, the cutter being a rapidly revolving wheel with many cutters. The machine carries an emery wheel for keeping the cutter sharp.

Whitening is similar to shaving, but is worked on both sides of the leather. Whitenings, being fine waste fibre matter, if taken from oily leather, are considered liable to spontaneous ignition if allowed to accumulate. The machine also has an emery wheel sharpener.

All three of the above machines might cause a fire from the sparks produced by the cutter-sharpening emery wheel. This should be confined in a metal shield.

Buffing is smoothing the leather on large sand or emery-covered wheels. Its hazard is measured by the character of the work and the arrangement of the machinery. Buffings from the grain side of leather are not hazardous, as little or no oily fibres are produced. Buffings from the flesh side of very oily leathers might be subject to spontaneous ignition. Chrome-tanned buffings will burn readily without flame, probably due to the presence of sulphur, and they will nourish a spark until

the whole mass is consumed. Buffings from extract-tanned leathers are not readily inflammable. Gambier buffings burn readily with flame.

Buffing rooms are necessarily dusty. They should be well shut off from other rooms and preferably should be located outside the main building. Locations over leather storage, tan vats, pickled skins or other large values constitute defective occupancy.

Buffings may become ignited by hot bearings, friction or the misuse of the wheels, such as for sharpening knives, and resurfacing them with a piece of steel instead of by a stone or brick. Buff wheels and fans should have self-oiling bearings and grease cups.

Buffing dust should be cared for by an approved blower system discharging to a safe place outside.

Small hose, chemicals or pails should be kept in service in buffing rooms.

Pressing is sometimes conducted to remove surplus oil.

Coloring and dyeing. Some leather, more often the heavy leather is colored by a mixture prepared from lamp black. This material is subject to spontaneous ignition and should be stored in a dry place preferably outside the main plant.

The other coloring agents are not hazardous, being usually prepared logwood or aniline colors.

Staking consists of drawing the leather over the dull edge of a piece of steel to make it soft and pliable. It may be done by hand or by machine.

Seasoning. Dried blood, gelatin, albumen, neats-foot oil, or olive oil is daubed over the leather, after which it is buried in damp sawdust for a time. This gives a special finish left dull for a "mat" finish and iron for a glazed finish. Old and oily sawdust constitutes a hazard.

Ironing is glazing by hot flat irons, usually gas or electrically heated. The means for heating should be arranged in a standard manner.

Glazing and polishing is done by machines and in morocco shops is extensively conducted.

Special Finishes.

There are many special finishes for fancy leathers and all sorts of compounds may be found in the finishing rooms.

Wax may be used, and the wax-melting hazard may be present.

Some leather is shellacked, introducing the alcohol hazard.

Lacquers containing gun cotton, celluloid, nitro cellulose, or whatever it may be called, are common and their use constitutes a marked hazard. The compound, celluloid dissolved in amyl acetate, is highly inflammable, as are also skins heavily coated with the mixture. Some tanners mix their own compound.

It is applied with a brush, usually from open dishes. This hazard cannot be too safely guarded. All supplies of the material should be stored and mixed outside.

There are various other compounds used in a similar manner, some inflammable and others not hazardous.

Embossing is pressing engraved dies upon the finish coatings of the leather to imitate the "grain" of certain skins or to otherwise ornament the surface.

The press is a heavy machine. Usually the dies are gently heated by steam. Gas, gasolene or electrically heated dies, if used, should be carefully arranged.

Chemicals.

Following is a partial list of chemicals which may be found in a tannery:

Acetic, muriatic, oxalic, sulphuric, lactic and formic acids, ammonia, borax, blue vitriol (crystals), copperas, sugar, salt, gluecose, flour, egg yolk.

The vegetable extracts: Sumac, hemlock, oak, chestnut, quebracho, etc.

The mineral tannins: Dichromate of soda, dichromate of potash, thiosulphate of soda, alum, in its different forms, and possibly formaldehyde. Also fat liquors and stuffing materials used in finishing, such as paraffine oil, sulphonated oil, castor oil, olive oil, neats-foot oil, degras, stearine, tallow, etc.

Other chemicals are glycerine, iron compounds, potash, soda ash, bicarbonate, sulphide and bisulphide of soda, hypophosphite of soda, aniline dies, lamp black, and various coloring and lacquering compounds.

Tannery Defects.

Construction. High buildings of light construction, large areas, steep shingled roofs and floor openings unprotected. Boiler house not cut off.

Occupancy. Boilers inside main plant. Tan vats in main buildings. Buffing in main buildings or over tan yard. Pickled skins in basements, or first stories, under hazardous occupancies. Lime stored inside. Bark mill not cut off or detached.

Protection. No adequate fire streams available. Lack of sprinklers, chemicals, stand pipes, pails, etc. No watchman or fire alarm. No trained fire brigade.

Exposure. Severe exposure. Unguarded exposures. Bark storage near main buildings.

References for Collateral Reading.

Note: These references are suggested as helpful supplementary reading for those fitting themselves for the examinations of the Insurance Institute of America.

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Chemical Hazards *

BY

MILTON F. JONES

Chemistry is variously defined, but in general terms it is that branch of science which treats of those phenomena in which an alteration of substance occurs.

Matter is indestructible. The usefulness of an object or substance may be lost, as when wood burns, but its component parts have passed into other forms, such as gas, vapor, smoke and ash, and the collective weight equals or exceeds that of the original substance.

When certain substances are brought into contact with each other, as iron and moisture, a chemical action occurs and the iron rusts. The attraction which exists between various substances, and which causes chemical change or reaction is known as chemical affinity.

Chemical affinity causes wood or other combustible matter when heated sufficiently to unite with the oxygen of the air and burn.

Chemical Elements.

Substances which have resisted all attempts to convert them into simpler substances, and which cannot be formed by the union of others are known as chemical elements. Thus iron, carbon, oxygen and hydrogen are elements.

About 85 elements are now known. Some, such as those given above, exist in abundance: oxygen in the atmosphere, in water, animal and vegetable matter, rocks, sand, etc.; carbon in animal and vegetable matter, oils, and various substances widely diffused. Many of the elements are rare and are found in small quantities only.

Elements are assumed to consist of atoms, these being the smallest particles or units constituting the elemental mass, and being identical as to size or weight for the same element. The size or weight of the atoms of each element, however, differs.

* Notes on chemical hazards based on lectures delivered to students in the evening classes of the Insurance Library Association of Boston, 1915-1916, following the courses of the Insurance Institute of America.

Molecules.

Atoms are combined into molecules consisting of two or more atoms, a molecule being the smallest separate particle which can exist in a free state. When atoms are set free by the decomposition of a compound, and before they combine with other similar atoms or with atoms of other elements, they possess or exhibit greater energy than when combined in a molecule. This condition is known as the nascent state. For example the molecule of oxygen contains two atoms. When another atom of oxygen is attached to the molecule we have ozone. The affinity for the third atom is feeble and the molecule parts with it when brought into contact with a substance for which it has an affinity and it is due to this atom of oxygen separating in a nascent condition that ozone is so effective as a deodorizer. The chemical union of two or more elements into a molecule forms a chemical compound as, water H_2O, carbon monoxide CO, and carbon dioxide CO_2.

Acids.

Acids are very important chemical compounds. They contain hydrogen which can be replaced by a metal, as for example HCl (muriatic or hydrochloric acid) which when allowed to act on zinc forms zinc chloride, $ZnCl_2$, as follows: $Zn+2HCl=ZnCl_2+H_2$ in which zinc has replaced the hydrogen of the acid and the latter appears as a gas.

Bases and Salts.

What are known as bases are compounds which uniting chemically with an acid form a salt. They usually contain oxygen combined with the metal, sometimes both oxygen and hydrogen, examples $NaOH$, sodium hydrate or caustic soda, ZnO, zinc oxide. Thus $ZnO+2HCl=ZnCl_2+H_2O$, that is, zinc chloride and muriatic acid form zinc chloride and water. From the foregoing it is apparent that a salt is produced by the union of an acid and base.

Gases.

Gases consist of molecules separated by distances which are great in comparison with the size of the molecules. The kinetic theory of gases assumes that the molecules are in constant motion, colliding with each other and with walls of the containing vessel. The pressure of gases is due to this condition. When a gas is heated the rate of oscillations increases and consequently the number of collisions or impacts, and is manifested by increased pressure if the volume remains constant, or by increased volume if the pressure remains constant. The

increase in volume equals 1/273 of the volume at zero, Centigrade, for each degree Centigrade the temperature is raised above that point.

The volume of a gas varies inversely as the pressure, that is, if a given volume be compressed to one-half the volume, the pressure is doubled, and conversely if a volume is allowed to expand to two volumes the pressure is halved.

Vapor Density.

Vapor density is the ratio of the weight of a given volume of any particular gas compared with air or with hydrogen. Thus, carbon dioxide gas is about three times as heavy as air and 22 times as heavy as hydrogen, and its vapor density would be 3, or 22, depending upon whether it was compared with air or hydrogen.

Diffusion of Gases.

Diffusion of gases is the property of mutually diffusing or mixing with each other even though their vapor density vary as noted above. It is owing to this characteristic that the atmosphere is always constant though composed of two gases, oxygen and nitrogen.

Liquids.

Liquids differ from gases in that the molecules are nearer each other, but free to move in any direction at or below the surface.

Vapor pressure or vapor tension is a characteristic of liquids, and causes evaporation. It increases with the temperature and when it equals the external pressure upon the surface of the liquid, we say the liquid boils. Thus the boiling point of water at normal atmospheric pressure is 212° Fahr. or 100° Cent., alcohol 173° Fahr. or 78° Cent., and carbon disulphide 117° Fahr. or 47° Cent. If the pressure upon the surface of the liquid be increased the boiling point is raised, and if the pressure be reduced the boiling point is lowered.

Solids.

Solids differ from liquids in that the molecules so influence each other that under normal conditions the shape of the mass remains unchanged.

When a solid changes to a liquid, heat is absorbed by it; example — melting ice or melting metal. When a liquid is changed to a gas or vapor, heat is absorbed, as when water is changed to steam. Conversely, when a gas or vapor changes to a liquid heat is given off; example — steam, when utilized

for heating, gives up its heat, is changed to water and returns to the boiler. Also when water, a liquid, freezes and becomes a solid, it gives up heat to the surrounding air or objects before it solidifies.

Molten metals must give out heat before solidifying.

All chemical changes such as formation of compounds, or breaking up of such are known as chemical reactions, and are accompanied either by generation or absorption of heat.

Exothermic Reaction.

Exothermic reactions are those in which heat is given out.

Endothermic Reaction.

Endothermic reactions are those in which heat is absorbed.

As a general rule, a compound the reaction of whose formation was endothermic is much less stable than one which was exothermic. In the former case energy was absorbed and this energy will be given out under favorable conditions.

Oxidation.

Oxidation is the combination or union of oxygen with a substance, as when iron is heated in air or when it rusts. Oxidation generates heat which may be evident or not according to the rapidity of the oxidation. The total amount of heat generated by the complete oxidation of a given amount of a particular substance is the same whether the oxidation be slow or rapid. Thus a given weight of charcoal will produce the same amount of heat whether it be burned in the air, or more rapidly in oxygen.

Combustion.

The union of oxygen with substances, if accompanied by heat and fire or flame, is what is generally understood by the term combustion. There are some substances whose union without oxygen produce heat and flame, and which is properly called combustion, but they are few and do not interfere with the common acceptance of the term.

Since oxygen is present in our atmosphere, and what are known as inflammable substances combine with it and burn, oxygen is called a supporter of combustion. The term is only relative, however, as oxygen will burn in an atmosphere of any gas which would burn in it.

Combustion may occur with or without flame. In order to create flame, part or all of the substance undergoing combustion must be a gas or evolve a gas, and must burn in an atmosphere of a gas with which chemical union can occur.

Rapidity of combustion may vary widely. Thus combustion may occur without flame, in which case we say it smoulders, or it may be accompanied by flame and be so rapid that it may be explosive. The term explosion is carelessly used in describing fires which may be only rapid combustion.

There is no sharp line of separation between very rapid combustion and explosion, but the term explosion, when accompanied by flame, as generally understood, is a condition in which a rapid and great increase of volume occurs. That is, where a solid or solids are converted into a large volume of gas exerting pressure, or where vapors or gasses combine and the heat generated expands them with consequent great increase of pressure.

Gasoline and various other volatile inflammable liquids are not explosive. They are inflammable and their vapors mixed with air in certain proportions are explosive.

Approximately:

Gasoline vapor and air is explosive when gasoline vapor equals 2 to 7%.*

Ether vapor and air is explosive when ether vapor equals 3 to 7.5%.

Alcohol vapor and air is explosive when alcohol vapor equals 4 to 13%.

Carbon disulphide vapor and air is explosive when carbon disulphide vapor equals 3 to 6%.

Coal gas and air is explosive when gas equals 7 to 30%.

Acetylene and air is explosive when acetylene equals 3 to 35%.

Thus in a mixture of air and inflammable vapor in which the proportion of vapor to air is less than the minimum the mixture may be inflammable but not explosive. As the proportion of vapor increases the explosive effect increases to a certain point beyond which a further increase of vapor lessens the effect until the limit of the proportion is reached. Beyond this limit the mixture owing to insufficient air is no longer explosive although it is of course inflammable.

Ignition Point and Heat of Combustion.

The ignition point is the temperature at which if a substance be heated in air it will ignite. It does not require contact with flame or fire. The approximate ignition point of yellow phosphorus is 113°-140°F.; of carbon disulphide 300°; of charcoal 572° upwards; of sulphur 480°; of acetylene 900°; of coal gas 1,150°.

Heat of combustion is the temperature created by the combustion of a substance. It is evident that if the heat of combus-

* The explosive range of gasoline is quoted by some as from 2 to 14%. This is probably due to the fact that gasoline is not a definite compound, but a mixture of various compounds and therefore samples vary.

tion be greater than the temperature of ignition, the combustion once started will continue. On the other hand if the heat of combustion be less than the temperature of ignition the combustion will cease unless it be aided by external heat supplied to the substance.

Spontaneous Ignition.

This is defined as ignition produced by the development of heat within the substance or mass, without the aid of an external agent. The most common cause of spontaneous ignition is the oxidation of a drying oil, that is an oil possessing the property of drying or hardening. Linseed oil is an example of such an oil. The conditions most favorable for spontaneous ignition are those in which the oil can have a large surface exposed to the air, as in rags or cotton waste, and the mass so arranged that the heat generated in the interior by oxidation may accumulate. The heat generated at the surface of the mass is radiated, but the temperature of the interior may easily rise to the point of ignition.

Animal and vegetable oils are most hazardous, but mineral oils, on waste and rags, as ordinarily used, may contain finely divided metal and other foreign matter and are hazardous.

All animal and vegetable oils consist of glycerine as a base combined with fatty acids, and so may be considered as salts. By saponification these acids may be separated from the glycerine. Saponified red oil used in woolen mills for oiling stock, consists largely of oleic acid, one of the fatty acids, is about as hazardous as linseed oil when material such as cotton rags or waste is impregnated with it. Upon wool, however, it is not hazardous, for although the temperature rises considerably it drops again without causing ignition.*

Cutting board scrapings as removed from the cutter's blocks in shoe factories are impregnated with drying oils, and in a mass afford ideal conditions favoring spontaneous ignition.

Vegetable substances, such as jute, hay, straw, etc., may ignite spontaneously, due to fermentation of the resinous and gummy constituents raising the temperature to a point at which chemical union and ignition can occur. The fermentation is probably due to bacteria.†

Finely divided metal or metallic powders if slightly moistened and especially if mixed with dust or inflammable material may cause ignition. Zinc dust, and aluminum and magnesium powders are especially hazardous, and should always be kept

* See article on Saponified Red Oil, National Fire Protection Association — Special Hazards Bulletin No. 12, p. 35.

† For description of Mackey Cloth Oil Tester used in testing oil for spontaneous ignition hazard see article on Saponified Red Oil, above cited.

in containers of glass or metal which will positively exclude moisture. It is hardly necessary to state that these powders, if very fine and diffused through the air in a room, may if ignited explode with violence.

Charcoal.

When wood is heated with insufficient air to produce complete combustion, as in a retort, the volatile matters are driven off and practically only the carbon and mineral matter originally present in the wood remain, forming charcoal.

Charcoal is very porous and when freshly burned possesses the property of absorbing several times its bulk or volume of oxygen, and certain other gases within its pores. The values usually given are, oxygen 9 times, hydrogen sulphide 55 times, and dry ammonia gas 90 times the volume of the charcoal. This compression of gas produces the same liberation of heat as if compressed mechanically and may aid the ignition of the charcoal.

Charcoal produced at a low temperature, that is, about 450° to 500° F. is known as pyrophoric charcoal. The process is not complete and in this condition the charcoal is likely to ignite spontaneously.

Volatile Inflammable Liquids.

Many such compounds are in quite general use, of which wood, denatured, and ordinary grain alcohol, gasoline and naptha are familiar to all.

The alcohols above named are *miscible* with water and are more rapidly extinguished by water if ignited, than liquids which are not miscible and which float upon the surface.

Carbon disulphide is heavier than water and therefore will not float. It is, however, one of the most hazardous volatiles, for in addition to its volatility its ignition point is very low, about 300° F.

Acetone is a liquid of the alcohol class, and as found in trade has a flash point of about 32° F.

Amyl acetate is an ether formed by combining Amyl alcohol and acetic acid and is used in the manufacture of lacquers, artificial leather, and as a solvent for soluble nitro or gum cotton for many purposes. It is not miscible with water and its flash point may vary from 60° to 70° F.

Hydrocarbons.

Petroleum yields by fractional distillation various compounds which as a class are known as hydrocarbons, as they consist of hydrogen and carbon. The more volatile ones are in a state of vapor or gas at ordinary temperatures and are

rarely met with. The more common are petroleum-ether, gasoline, benzene, ligroine and naptha. There is a difference in their boiling points, some boiling at lower temperatures than others and are consequently somewhat more hazardous, but as the flash points of all of them are low, the difference is generally of little consequence.

Another group of hydrocarbons is obtained by the distillation of coal tar and from coal gas. Among the more volatile ones are benzole, toluol, and zylene, and these are present in what are known as "light oils," the lower or first liquids coming over in the distillation.

There is practically no difference in the hazards of the two classes of hydrocarbons of the same flash points.

The petroleum or open chain hydrocarbons are scarcely affected by chemicals, even the strong acids. The coal tar or closed chain compounds, however, are easily acted upon by acids and always with the evolution of heat and consequently of inflammable vapor. The relative hazards of inflammable volatiles are determined largely by their flash points.

The flash point is the temperature at which an inflammable volatile gives off sufficient vapor to ignite if a small flame is brought into contact with the vapor. The liquid does not ignite at this temperature. The flame must be very small in order not to heat the vapor, and the test may be made in either an open or closed cup apparatus. The flash point is generally a few degrees higher in the former apparatus.

The fire or burning point is the temperature at which the liquid will ignite under same conditions of flame contact.

A good grade of kerosene oil has a flash point of about 100° F. while carbon disulphide flashes at about 29° below zero F.

In addition to the flash point the vapor density of inflammable volatiles is an important matter in considering their hazard.

Acids.

Acids such as acetic and hydrochloric ordinarily are not hazardous. Nitric and sulphuric acids are the most hazardous of the strong acids. Nitric acid readily gives up part or all of its oxygen if brought into contact with substances for which it has an affinity, and which if inflammable may be ignited. The brown nitrous fumes given off when strong nitric acid is brought into contact with some substances may, if brought into contact with materials such as cotton cause their ignition.

Strong sulphuric acid evolves heat when it absorbs moisture or water, or when in contact with substances from which it can abstract hydrogen and oxygen in the proportions necessary to form water. Strong acids should not be stored in basements or cellars unless proper drains are provided, and means for

flushing out the acids in case the carboys or containers should be broken. Strong nitric acid fumes are very dangerous if inhaled and may result in loss of life to firemen.

Oxygen Carriers.

Nitrates, chlorates, and peroxides are known as oxygen carriers and contain oxygen which they readily give up under favorable conditions to any oxidizable substance, and are likely to cause ignition. They are always a hazard when in contact with inflammable material.

Sodium peroxide when combining with water evolves much heat and if quantity of water is small as compared with peroxide, and it is in contact with inflammable material generally causes ignition. If the quantity of water is large the heat is absorbed by the water without danger, and the liquid resulting is simply a solution of sodium hydrate or caustic soda. It is used for bleaching purposes and if used intelligently by those familiar with its hazards it is relatively safe. It should not be stored in a damp location and it is not hazardous if heated, unless in contact with combustible material.

Nitrocotton and Celluloid.

Nitrocotton, pyroxylin, soluble gun cotton, and collodion cotton are names applied to cotton which has been treated in a mixture of nitric and sulphuric acids. The sulphuric acid does not enter into the reaction but absorbs the water formed and so prevents the dilution of the nictric acid. Although not as powerful an explosive as the explosive guncotton it is capable of generating considerable force when ignited and should not be kept or stored in a dry state. When containing 20% of water it will not ignite if brought into contact with flame until the moisture has been driven off. If the nitrocotton has not been completely freed from the nitric acid it may decompose and spontaneously ignite.

Nitrocotton dissolved in amyl acetate forms the basis of most of the lacquers used for coating metals. The solution is no more hazardous than the solvent used, that is the inflammable volatile is the hazard and not the cotton.

Notrocotton combined with camphor forms the compounds known as pyroxylin plastics and irrespective of the make are commonly called celluloid. Celluloid is not explosive, as the camphor has a retarding action. It gives out much heat in burning, and when heated slowly to a temperature of from about 250 to 340 degrees F., the decomposition may be attended with flame, and some explosive force if the ratio of air be favorable. Celluloid requires air for its combustion and will not

burn in its absence; it will, however, decompose evolving gas and leaving a residue. Celluloid can be extinguished by water if the ratio of water to celluloid be great enough to produce the necessary cooling effect.

Nitrocotton is also used in the production of artificial leather. The cotton dissolved in a solvent, usually amyl acetate, is mixed with castor oil and pigments and applied to the fabric. The resulting product is not much more inflammable than other oil coated fabrics, and so far as known does not present the hazard of spontaneous ignition.

Picric acid (trinitriophenol) is a salt formed by nitrating phenol, commonly called carbolic acid. It is a yellow salt used to some extent as a dye, and as one of the so-called intermediates, from which other dyes are formed. It is also employed extensively in connection with other salts in the manufacture of high explosives. Ordinarily when ignited it burns with a smoky flame and without explosion. When heated it partially vaporizes and the heated vapor may explode. It can be exploded by a detonator. It should be kept in a moist condition, 10% water. The salts of picric acid are explosive.

Trinitrotoluene is produced like picric acid by nitrating toluene, is used similarly as a high explosive and should be kept in a moist condition.

Hazards of Experimental Work.

Experimental operations involving the use of chemicals in the hands of inexperienced persons are always attended with danger. Some powerful explosives are easily produced from simple substances. Thus potassium chlorate and various organic substances, such as sugar, can be exploded by a blow, iodine and strong ammonia form nitrogen iodine, a compound which when dry can be exploded by a gentle heat or even by the friction of a feather. When a solution of mercury in nitric acid is poured into alcohol, mercury fulminate is formed. This is the compound which is employed in the manufacture of primers and detonators for blasting caps. When an electric current is passed through a saturated solution of ammonium chloride nitrogen chloride is formed, a powerful explosive of an oily nature, and which in contact with oils, turpentine and other bodies will explode with violence.

A solution of phosphorus in carbon disulphide forms a solution which poured upon inflammable material will cause its ignition upon the evaporation of the solvent.

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Correspondence

BY

R. M. BISSELL

Business Correspondence.

The suggestions and observations contained in this paper are intended primarily for those whose duties include correspondence with agents, policyholders, and possibly field men, all under the jurisdiction of the head office of an insurance company. In other words, we are talking from the home office point of view. It is hoped however, that these comments and suggestions may be useful to some extent also to those who are engaged in other departments of insurance work.

The correspondence which emanates from the home office of an insurance company affects the progress and standing of that company to an extent which is often overlooked or not appreciated. We must remember that the letters which go out from the various company offices every working day of the year have — and this is true of every letter which goes out — a certain definite effect upon the receivers thereof. This effect is not always just what is intended by the writer, who in the hurry of business does not stop to think perhaps how his letter will appear when read by eyes considering the subject in hand from another point of view than that of the home office. It is not too much to say that home office correspondence is a very powerful influence in the acquisition, maintenance, and proper conduct of the business of every company.

It will be well to have in mind as we consider this subject — and it would be well to keep always in mind when writing letters — some definition of a letter. What is a letter? And what is its purpose? A letter may be incompletely defined as an instrumentality for transferring thought from one person to another by means of written language. The essential part of this definition of course is to be found in the words "transferring thought." Since the purpose of letters is to convey thoughts it follows that letters fail of their purpose to the extent that they fail to convey accurately the thoughts in the mind of the writer at the time when the letters are written.

Formerly a large and well-known book-store in Chicago had painted on its window shades, which were always decorously pulled down on Sundays, the following text: "Words are the only things that live forever." Sometimes it seems as though

this text had especial reference to those occasional letters which tactlessly written or stupidly expressed steal quietly out from the home office of an insurance company and lead indefinitely thereafter harmful and malevolent lives in the minds of their receivers.

The spoken word cannot indeed be recalled but its meaning is tempered or emphasized, softened or driven home by accent and intonation and even more perhaps by the facial expression and the glance which accompanies it. Again, we can usually quickly measure, in part at least, the effect of our spoken remarks and can supplement them if need be by explanations which will cure or mitigate any wrong impressions which they might otherwise have caused. Not so with our written utterances. They go forth in cold type without helpful explanation and with no cordial smile to soften them. They become a permanent influence not only upon those who receive them but upon ourselves — who are often to a greater extent than we would wish committed by them to an attitude or to a policy which is, on subsequent thought, by no means satisfactory to us. In one of his earlier essays Robert Louis Stevenson says: "Talk is fluid, tentative, continually in further search and progress, while written words remain fixed, become idols even to the writer." That is a very true and illuminating sentence and defines with admirable clearness the distinction I have been trying to set forth. It is largely because letters are not fluid and tentative but on the contrary are fixed and predestined to convey definite impressions that the skill or lack of it with which they are written becomes so vital a matter. There are other considerations, some of which will appear later on, which make the proper conduct of correspondence in our business of especial importance.

Now, let us consider some of the more obvious qualifications of good business correspondence. In their order of merit and importance it seems to me these most essential characteristics could be listed as follows:

1. Clarity.
2. Discretion.
3. Courtesy.
4. Form, i. e., proper use of the English Language.

Of these the first is naturally of by far the greatest importance, even though it is true that a letter may be very clear and at the same time very objectionable. But clearness we must have at any cost. A good many things are involved in this matter of clearness. In the first place, clear thinking is necessary for clarity in writing. If you do not have a definite understanding of a proposition in your own mind you can hardly hope to give a correct idea of it to another. Indeed, I am inclined to believe that lack of clearness proceeds more often from a corre-

spondent's muddiness of thought than from any other one cause, although another factor, namely: ignorance of and lack of training in the meaning and use of words, prevents many intelligent men from writing good letters.

The extent to which many words are used by people who fail to apprehend their meaning is enormous. Most of us have a few words in our vocabularies the real meanings of which are rather hazy in our minds, and many of us have very long lists of such words. It is a good rule never to use a word in a letter unless you know quite definitely what it means, and if you will take the trouble to look up in a good dictionary many of those words which you like to use but concerning whose meanings your knowledge is not complete you will find that you have probably been conveying by your use of the words ideas to your correspondents which you by no means intended they should receive from your letters. We all have run across some instances of the mistaken use of words highly enjoyed by their users on account of their length, sonorous sound, or foreign derivation, which are absurd, grotesque, and occasionally very amusing. But consider how such a faulty use of words is likely to delay or impede the accurate transferrence of thought from one person to another. I have one correspondent who is very fond of the word "mitigate" and uses it on every possible occasion and almost invariably erroneously. In his mind mitigate means about the same as the expressions "is a factor" or "makes for." He would be very likely to say, "One of the unfavorable factors which will mitigate against us this year, etc." You all have seen examples which even more closely resemble the language of Mrs. Malaprop than this. Better use always the commonplace word you are sure of rather than some more elegant one of whose meaning you are not entirely certain.

There are one or two bad habits which prevent us often from presenting our thoughts as clearly and distinctly as we should like to do. The most common of these habits are the practice of using adverbs and adjectives improperly and indiscriminately, and the mishandling and particularly the misplacing of the relative pronouns. The little word "that" especially has a most mischievous way of locating itself at the wrong places in our sentences and must be closely watched and kept under strictest control. Explanatory phrases, parenthetical in nature, often break up an otherwise well formed sentence and destroy its effect. Such things are real handicaps to expression and only careful attention and study will prevent them.

Included in this matter of clearness is the necessity for the definite expression of a decision which your letter is intended to record or for definiteness in the statement of the questions which your letter asks. This needs but to be mentioned to be understood. Nothing makes more for the unnecessary pro-

longation of a correspondence than half questions and qualified decisions. Be sure that your own thought is conveyed in unmistakable terms and language, and in this connection it is worth remembering that your correspondent may not and probably does not know all the facts and circumstances which have led you to your conclusion so that while brevity is an important requisite it is a mistake to so condense your letter that a correspondent, who is not so familiar as you are with all the facts or who perhaps has not had the advantage of your training and experience in the insurance business, will fail to grasp the reasonableness of the attitude taken by you, if indeed he does not altogether miss the point of your letter. In other words, let your letters be tempered by consideration for the knowledge and experience of the persons to whom you write.

It is particularly important that every letter which contains instructions should be unmistakably definite whether the instructions refer to the cancellation of a contract or the authorization of risks. It must be remembered also that in our business much of our correspondence has to do with matters and transactions which are governed by contracts highly technical in their nature. This is another and a most important reason why in our business this matter of clarity is of supreme importance. It is very easy in a letter to waive important provisions of a contract. It is very easy also to write a letter which by implication gives authority or assumes liability beyond the intention of the writer. When we insist therefore that great care should be taken to make all such letters definite, we mean not only that they should clearly state what the writer has in mind but that the language used should be such as to limit their application or possible use strictly within the bounds of the writer's intention.

The next prime requisite of good correspondence mentioned in our list is discretion, though many would doubtless consider the matter of courtesy even more important. It is indeed hard to say whether lack of courtesy or lack of discretion works more havoc through our correspondence. But we will consider the matter of discretion first. This subject is to a certain extent touched upon in the topic which we have just been discussing, and several of the cautions already urged are made more imperative by the importance and necessity of discretion.

The business of insurance — especially certain branches of it, such as fire insurance, burglary insurance, accident insurance, and some forms of liability insurance — involves the consideration of that great set of factors collectively known as the moral hazard. Now, the moral hazard is something which is very real but which for obvious reasons must be handled carefully in our letters. It will hardly do to say that you suspect an assured of being a fire bug, a thief, or a trickster, though possibly some such impression may be very firmly fixed in your

own mind. Again, as an aid in considering this question of moral hazard, the records of individuals and firms are collected either by companies themselves or by bureaus, commercial agencies or individuals who make a business of collecting such records, records which are consulted every day in our offices. Usually, our contracts with the compilers of these records compel us to make use of them in the most confidential and careful way but unfortunately this requirement is too often overlooked by those who are compelled in their correspondence to convey instructions which are based upon this confidential information. It is highly improper of course to refer directly to such records in correspondence and it is even dangerous many times to use such apparently harmless expressions as "We learn that so and so is the case" and "It is reported to us that the assured is said to have done this or that dishonest thing" and "Our information is to the effect, etc." Very often it is necessary not to indicate in any way the reasons which impel you to decline to accept or to authorize a given risk or to deal with a particular individual or firm. If any reference to this confidential information at all is made it is wise to use some such expression as: "Our impression is that this firm has had an unfortunate business experience" or "We think you will find on investigation that this risk is undesirable in the following particulars" or again your correspondent may be asked to make a careful investigation to ascertain whether or not certain conditions exist, conditions which of course you feel certain from your confidential information do exist but which you do not venture to allege for fear of being asked to disclose the source of your information or because you may be called upon to prove any assertions you make in positive terms. There are many ways by which the impression given by the confidential records can be put clearly into the mind of your correspondent without quoting the records or even referring to them in any direct or indirect way. And those whose duties make it necessary for them to consult and use such sources of information should never forget this very important matter. Otherwise, as has happened in more cases than one, libel suits or at least very unfortunate results of another sort in the way of arousing hostility and bad feeling may be brought about.

In many states there are stringent so-called Anti-Compact Laws. These are usually aimed at fire insurance companies though in not a few instances the wording of the statute is so broad as to include all kinds of insurance companies. These laws generally are intended to prevent any agreement or understanding among companies which will establish a fixed scale of rates and it should always be borne in mind that corporations must obey to the letter the laws of the states in which they operate. In such states — in the case of fire insurance at least, — there usually exists bureaus or private firms which survey

the different risks in those states and publish what are known as estimates of rates at which the individual risks may be wisely underwritten. Usually also most companies operating in such states purchase this information from the bureaus or individuals who publish it and base their own quotations upon the information thus obtained. It would indeed, occasion surprise if a company ordinarily coöperating with its associates in territory where coöperation is permissible should in a state where such coöperation is forbidden endeavor to secure business by means of quoting rates lower than those published by the experts engaged in surveying and recommending estimates for the various risks in the state. This is not because of any agreement between companies but because any company official who is not short-sighted realizes that such a policy if continued must soon bring about chaotic conditions as to rates in the states in question so that the advantage gained would be temporary and by no means commensurate with the subsequent loss of income and profit which would surely ensue. Furthermore, such action might result in destroying coöperation in states which permit it.

We are, however, so accustomed to membership in the various organizations maintained by insurance companies and their agents that we fall into habits of speech which sometimes lead us to write very dangerous letters. For instance, it has repeatedly come to my knowledge that letters have gone out from the offices of insurance companies referring to the advisory estimates above mentioned as "tariff rates," even as "local board rates," and some letters have been found stating that the company could not accept business at less than the "regular bureau rates." What will be the opinion of state officials who discover a number of such unwisely worded letters in the hands of a single agent and referring perhaps to the same risk? Will they not think and with reason that the companies from whose offices such letters have emanated had an understanding or agreement whereby business was to be declined unless the rates published by the bureau or expert rater were secured? In the circumstances mentioned therefore, it is wiser and just as useful to confine your comments on rates to their adequacy or inadequacy. No law can forbid your saying that a rate which is offered is an inadequate one. You are furthermore quite warranted in writing in some such way as this: "Our experience and investigations lead us to believe that this risk is worth not less than blank per cent. and if it is not possible to secure at least that figure we prefer to decline the business."

In the discussion of the necessity for clearness in correspondence reference was made to the fact that unless a letter was clear and definite it might contain implications committing the company in the eyes of the receiver to something beyond the intention of the writer. It should also be borne in mind that

each letter establishes a precedent. We must be careful, therefore, not to establish precedents which will later be embarrassing and in this connection it is to be borne in mind that in our business as in every other some of the people with whom we deal are disingenuous — tricksters, if you will — and that such persons are more likely than others to scrutinize your letters with a view of reading into them something beyond and even quite contrary to your intention.

The next requirement for a successful correspondent is that he should be courteous at all times. This does not imply lack of firmness but does require that attention should always be paid to the form in which a letter is couched, no matter how strong its declarations may be. Just as it is one of the requirements of a successful adjuster that he shall adjust losses in such a way as to pay no more or less than the company's incurred liability and at the same time as a rule maintain harmonious relations with the claimant, so also the successful office correspondent is one who will maintain the policy of the company with its patrons, agents, and field men even when the carrying out of that policy means loss of income or other hardship to those to whom his letters go and yet will retain their good-will and respect. If you will get yourselves into the habit of keeping in mind the thought — "How is this letter going to sound to the man who receives it?" — you will be more apt to appreciate the wisdom of giving courteous expression to your thoughts and requests. The requirements of courtesy may be fully met without sacrificing strength. The writer has seen not a few letters which were intended to be courteous but which succeeded only in being apologetic. The companies you represent are entitled to the information which your letters call out and have a perfect right to demand that their business shall be transacted according to the rules by which they have elected to be guided so that while courtesy is necessary it must not displace more important considerations. Courtesy without firmness is even more objectionable than firmness without courtesy.

Many letters which come into our offices are foolish: others are so poorly expressed as to be hardly understood: still others contain requests which are unreasonable to an extent that sorely tries our patience and good nature. The thing to remember is that corporations like those which we serve are engaged in the business of furnishing service of one kind or another to the public and that service without courtesy is likely to be a very poor kind of service. Now, by courtesy I mean not merely the use of polite phrases, necessary though they be, but the expression in your correspondence of a courteous attitude of mind. Unless courtesy has a real lodgement in your mind and intentions, it will be very difficult to put it properly into a letter. Mere lip courtesy has been much overdone in so-called business

correspondence during the past few years. There are throughout the country many correspondence schools whose advertisements lead readers to believe that a successful business man can be created by a course lasting a few weeks or at most a few months and that such matters as successful handling of correspondence are merely tricks of trade. Such is not the case. There is no royal road leading quickly and easily to education and knowledge in this or any other department of endeavor. The myriad form letters, stock phrases, and particularly the over-enthusiaum and the unreal and assumed energy which are so patent in much of the literature sent out by these correspondence schools largely fail of the effect which they are supposed to produce. It is perhaps not too much to say that much of the literature of these schools becomes decidedly nauseating and wearisome to those to whom it is addressed. Your courtesy must be inspired by a feeling within you, by an appreciation of the necessities and equities of each case which you are considering. Courtesy by formula will not answer. After all our own personality and our mental attitude will show themselves in our letters despite our best efforts. Therefore, at the risk of reiteration, I ask you to remember that the spirit of service must be back of your courteous language if that language is to accomplish results of real value.

The last qualification listed I have named, "Form, or the proper use of the English Language." I speak of this as though it were a distinct factor in the general subject we are discussing but of course it will be apparent upon a moment's consideration that one cannot be clear, discreet, and courteous in his correspondence without a certain command of the tool employed to convey his thoughts, namely: the English language, and I have already dwelt upon the necessity for an accurate understanding of the meaning of words as preliminary to the various qualities which we have been discussing. Whatever may be the canons of personal and friendly correspondence, the first rule of business correspondence, in so far as it is compatible with the other considerations which we have mentioned, is brevity. Business letters are written and read by busy men. there is, therefore, no room for useless surplusage. When enough has been said to make your meaning clear, it is time to end the letter.

Ordinarily simplicity in form and language is almost as important as brevity. In the general run of business you are not called upon to write in an elegant fashion. Simplicity of form tends toward directness and clarity of expression and that, as we have seen, is the first requisite of a good business correspondent. Let your language be simple but combine your simple words and phrases into sentences which are grammatically correct and properly formed and arranged. For the kind of correspondence which we have been considering the less you

think about "style" the better. Indeed, if you are careful to be clear, accurate, discreet, and courteous in your letters and at the same time are well enough grounded in the use of the English language so that your letters are as to grammatical construction correct, your "style" will take care of itself.

Thus far our discussion of the entire subject has chiefly concerned itself with that preponderating mass of business correspondence which goes out day by day from company offices, conveying instructions, authorizations, criticisms, explanations, etc. There are other and higher functions of office correspondence, however, for which you must be prepared as you rise in the service and come to occupy more important positions. You will then be called upon to write letters which have to do with outlining of policies of your company or with the expansion or acquisition of business on a large scale, the creation of good-will, the discussion of contracts, and various other important matters. This kind of correspondence often calls for something more than the routine correspondence which we have been for the most part considering. This final function of business letter writing needs to have behind it the power and facility to convey conviction, to persuade, and is greatly assisted by the introduction of a pleasing quality into your letters. In other words, this final function of letter-writing requires that what is known as a good style be cultivated.

One of the chief dangers to be avoided by him who seeks to acquire a good and pleasing style of writing is to be found in the bad habit of constantly using the same words and phrases in discussing the same or similar matters. Do not let your style become so monotonous that anyone who has received a few letters from you knows exactly what you are going to say upon any given subject. These constant reiterations and this unvarying lack of variety in letters make them wearisome, fatigue the attention, and make it impossible for them to produce the effect desired. The best, if not the only, means of avoiding this fault is by the enlargement of your vocabulary.

There seems to be no other — or at least no better — way of acquiring a good English style, including an enlarged vocabulary, than by reading and studying the works of the best English authors. In a great majority of cases the man who can write a fine letter will be found to be a well-read man, not merely a reader of newspapers and magazines but a reader of good books. The author whom we have already quoted, Robert Louis Stevenson, in another portion of his writings dwells at great length upon this and gives an account of his own endeavors to acquire a good style, an effort in which he was supremely successful. He states that having made a study of certain masters of good English he would endeavor to describe an event or a scene in the exact language that they would have employed and that during certain periods he consciously

endeavored to make all his writings resemble those of some particular author whose work he was studying at that time. Such a process is hardly to be recommended for our purposes. Nevertheless, the study of good literature offers the best method for the improving not only of one's style, which we are just now considering, but also for acquiring the correct use of English words and the power to express one's thoughts clearly and in a pleasing manner.

Someone may at this juncture ask what books or what authors are to be recommended to be read with this end in view. Of older books there can be little doubt that the St. James version of the Bible stands preëminent in its influence upon the literary style of the men who have most successfully handled our language. Nowhere else is there to be found purer or better English than in that version of the Scriptures. The truth of this observation is well illustrated in the writings of Abraham Lincoln. It is hardly too much to say that the best things he wrote or said from a literary point of view owe their beautiful and classic form to his knowledge and appreciation of the Bible as a literary work. The works of Shakespeare also of course have had an enoromus influence upon their readers. Those of you who were fortunate enough to have an opportunity or reading many of the letters of the late J. D. Browne, President of the Connecticut Insurance Company, will not have failed to note the influence of both of these forces upon his mind, thought, and language, and there have been few men in our business, by the way, who could write finer letters than those which came from his pen.

If I were asked to recommend a list of modern writers, the reading of whose works would be helpful for our purposes, I should name the following. The list is by no means exhaustive — is rather very incomplete — but embraces a few of those whose command of our language is noteworthy.

Thomas Carlyle
Joseph Conrad
John Galsworthy
Prof. Huxley
Admiral Mahan
Robert Louis Stevenson
Elihu Root
H. G. Wells
President Wilson

Each of these in his way is a master of English. For a business man it is questionable whether a better model could be found than the English employed in the essays of Professor Huxley, who not only stated his convictions with great clearness and force but even when treating of abstruse subjects was able to make use of such a charming literary style as to doubly emphasize the effect of what he wrote. All of these men have the faculty of occasionally making use of an unusual word which arrests the attention and vivifies and particularizes the meaning of the phrase or sentence wherein it appears.

These observations, for the most part of an elementary nature and necessarily also for the most part suggestive rather than definite, it is hoped will nevertheless convey to you an idea of the importance of this general subject. It would, in fact, be hard to exaggerate it from the companies' point of view and it is scarcely less important as affecting your own individual progress. Many an intelligent and otherwise successful member of an office force has been held down to the lower grades of work by his inability to acquire a mastery of the art of correspondence. There is probably not a head office in this city that does not contain more than one example of this kind. Those of us who are called upon to look over the letters of others are often filled with a sense of discouragement at their inadequacy and their imperfections. Furthermore, it makes little difference what kind of work you are now doing. Your value will be increased if you can augment your ability as a correspondent.

I sincerely hope that the few remarks I have made to you this evening will cause some of you to give thought to this matter and that the results may be manifest in the greater measure of success which shall hereafter come to you.

Processes and Hazards of Metalworkers

BY

F. MINOT BLAKE

Processes and Hazards of Metal Workers.

An attempt will be made in this paper to give a brief description of the principle processes and hazards in the metal working class, and for convenience the subject will be considered in three main divisions, first *foundries* and *forge shops*, second heavy metal workers such as *rolling mills*, *structural iron workers*, *machine shops* and third, light metal workers, manufacturing small articles including jewelry, with some remarks in regard to hazards common to all divisions. However, the subject is so broad, that a sub-division is difficult, because any particular property under consideration might contain all the hazards of the entire class.

The main process in the foundry consists of converting the metal from its rough form into a molten state, then pouring into molds and allowing it to again solidify by setting or cooling. The two principle materials used are the metal, iron, and the alloy, brass, and the processes used are similar except that of reducing the material to a molten state. The processes of an iron foundry will be considered first and include manufacturing the patterns and cores, making the molds, melting the iron, pouring into the molds and finishing. The molds are formed of sand, which encloses the patterns and cores and the patterns are then removed, leaving the spaces in the sand, into which the molten metal is poured. A special kind of sand must be used so as to give as smooth a finish as possible to the casting and also to be porous enough to allow the escape of the gases generated when the hot metal is poured into the mold. For small castings the sand mold is made in a flask, which is a wooden frame in two or three parts, so arranged that they can be separated and the pattern removed, then placed together again ready to receive the molten metal. For large castings, the mold is built up in an excavation in the foundry floor, braced and supported by fire brick and finished with loam. The patterns are usually made of wood and the process of manufacture involves rather light hazards of the woodworking class, there being no dry kiln hazard and no important finishing hazard although the patterns are painted or shellacked. The principle hazard in this process is the care of the refuse. The cores are made

of sand and paste formed into the desired shape in wooden frames, called core boxes and then baked hard in the core ovens. The only hazard here is the ovens and care should be taken that they are properly installed and clear of all inflammable material. The ovens are heated by various means, hard coal, fuel oil or gas.

The main and most important process in the foundry will now be considered, that of melting the iron and it is done in a furnace called a cupola, which is a high vertical cylinder made of boiler iron, lined with fire brick. A common size is about fifteen feet high and three to five feet internal diameter and the bottom is about four feet above the floor, the cupola being supported by iron legs. Near the bottom is an opening for removing the molten iron and also several other openings called tuyeres, through which is blown air under forced draft from a blower. The cupola is charged with kindling wood at the bottom, with several successive layers of anthracite coal or coke and iron in the form of pigs. The opening for removing the molten iron is plugged with clay, the kindling ignited, the air blast turned on and the burning coal or coke reduces the pig iron to a molten state, and it is drawn from the cupola by removing the clay plug, into clay pots or iron pots lined with clay and taken into the molding room and poured into the molds. The cupola hazard is a furnace hazard, with the additional hazard due to more or less molten iron that may be spilled near the base of the cupola, and there should be no combustible material near the cupola or its stack. Because of the method of heating, an immense number of sparks are thrown out of the chimney from the cupola, so there should be no combustible coverings permitted on roofs of nearby buildings and no combustible yard storage, and suitable shields should be installed at the top of the stack.

The process of pouring the metal does not involve any particular hazard, although there is the danger of some of the metal being spilled and setting fire to any combustible material, but these fires are of little consequence, as the only combustible material present is the wooden flasks, the foundry floor being universally of earth or sand. There is the chance of the mold being too damp, so that when the molten iron is poured, a large amount of steam is generated and the casting explodes, scattering the molten metal, but this is a rare occurrence. After the castings are cool, they are taken from the sand and finished, this process being merely chipping off the rough places with a cold chisel or grinding off the rough edges on emery wheels, run by power, with no particular hazard. Care should be taken that the flasks are put in a safe place after the castings and sand are removed, as fires have started from hot and smouldering flasks.

As before stated, the processes of a brass foundry are similar to an iron foundry, excepting in the melting. Brass is melted in black lead crucibles in a furnace, usually heated by coal, the process involving a furnace hazard. There is the further distinction that brass castings are usually so much smaller than iron, that the hazards are on a smaller scale, and frequently a brass foundry is in part of one of the main buildings, while an iron foundry is always in a building devoted solely to that purpose. Particular care should be taken if the brass foundry is in the main building.

The latest National Fire Protection Association's fire record of foundry fires shows 364 fires with known causes, with approximately 75% from special hazard causes, which is a large percentage and shows the class to be hazardous. Forty-two per cent. of the special hazard fires were due to the cupola, twenty-four per cent. to core ovens and furnaces, and sixteen per cent. to pouring, and although the figures are not given, undoubtedly the fires caused by pouring were of minor importance, leaving the cupola, core oven and furnace responsible for most of the foundry fires. The hazard is so evident and so easy to safeguard, that it is surprising better care has not been taken in installing these furnaces.

The process in the forge shop consists of heating the metal, usually wrought iron, so that it may be shaped into any desired form, either by large steam hammers or by hand hammers on anvils. For making large forgings, brick furnaces are used for heating the metal and care should be taken that the furnaces are well arranged, including proper arrangement of flues. For making small forgings, the small familiar iron forges are used, with iron pans on which coal fires are built, the iron to be heated being placed directly in the fire; forced draft is used by means of a blower and a system of galvanized piping connected to all the forges. Hoods should be placed over the forges, all connected by another system of piping to a chimney to carry off the hot gases, etc. The forges should be well set and the flues and chimneys properly arranged, the flues not to be run in places where inflammable dust could collect on their surface. The floor of the forge shop should be non-combustible, either concrete or dirt.

Preliminary to taking up the heavy metal workers, consideration will be given to the manufacture of pig iron and the making of wrought iron and steel. The blast furnace is the universal means of obtaining pig iron from iron ore. A blast furnace is similar to a foundry cupola, but much larger, the charge in the furnace consisting of iron ore, limestone and fuel in the form of coke, anthracite coal, charcoal and occasionally bituminous coal, and the charge is melted down in a similar way, as in the cupola, excepting the air blast is heated by passing the air through a series of brick stoves, done to economize on

fuel in the blast furnace. The molten iron is drawn off from the blast furnace and cast in rough molds in the form of pigs. Pig iron is used without change in foundry work and used for the manufacture of wrought iron and steel, the distinction between wrought iron and steel being the amount of carbon present, wrought iron being practically free of carbon and of great use in blacksmith shops, as it can be readily forged.

The process of converting pig iron into wrought iron is known as "puddling" and is done in a brick reverberatory furnace, on a hearth with a brick arch over it for reflecting the heat. Either gas or coal fuel is used and the pig iron melted and the oxygen for the removal of the carbon and impurities is furnished by the slags and oxides of iron added. When the process is finished the iron is balled up by hand with iron tools and run through rolls into the form of bars.

There are three main processes of making steel, the Bessemer, Open Hearth and Crucible methods: Bessemer steel being used for rails, structural iron, agricultural tools; Open Hearth steel for rails, structural iron, springs, shafts and armor plates, and Crucible steel for high grade tools, razors, etc.

In the Bessemer process, the pig iron is obtained direct from the blast furnace in a molten state or is melted down in a cupola. The molten iron is then poured into the converter, which is an iron vessel open at the top and lined with some form of sandstone and air blown through the molten iron, oxidizing the carbon, converting the metal into wrought iron and the required amount of carbon is added in some form to change the molten mass into steel, which is poured into large molds of rough shape, forming what is known as "ingots."

The Open Hearth process is done in furnaces similar to the puddling furnaces, the charge being pig iron, ore and scrap, but the charge when finished is drawn off through tap holes and cast into "ingots."

Crucible steel is made in clay or graphite crucibles, placed in a furnace and resting directly on a coal fire. The charge consisting of bar iron and charcoal, is melted down and poured into small molds.

The principle hazard of all these steel manufacturing processes is the furnace hazard and all the processes should be carried on in the open or in non-combustible buildings, and this is usually the case in practice.

The principle class of heavy metal workers is composed of rolling mills, structural iron mills, plate mills, etc., and in connection therewith is usually found more or less of the steel manufacturing processes. The main process of rolling the metal out into desired shapes is not hazardous and consists of passing the steel ingots heated to a plastic state between rolls of various

shapes, then sawing the product into the desired lengths. The principle hazard is in connection with the handling of the hot metal and all floors should be of non-combustible construction.

Some mention will now be given machine shops, but this is the least hazardous of all the metal working classes. The processes here consist in working the castings, rods, plates, etc., into the desired form, by means of power machine tools, such as lathes, planers, shapers, drills, etc. The machinery is not fast running and the process of cutting the metal by edged tools presents very little hazard. There is a mild hazard in some types of automatic machinery due to the fact that the cutting is done in the presence of a small continuous stream of oil and an undesirable condition is liable to result, that is the floor may become oil soaked and sometimes sawdust is used to absorb the excess oil, because in spite of precautions the surroundings become very oily.

The light metal workers will now be taken up, this class including plants making jewelry, metal novelties, lamps, fixtures, etc., and the hazards here are much greater than in the machine shop class, due to the fact that the machinery is run faster, and there are additional hazards due to soldering, lacquering, japanning, electro-plating, buffing and polishing. Soldering is usually done by means of a small gas flame in direct contact with the metal and there is generally a series of gas jets, arranged at intervals along a bench. Either city or gasoline gas is used in conjunction with air blast, fixed iron piping being used with connections made to the burners by rubber tubing. The benches should be of metal and there should be a main valve controlling the gas supply and the foreman of the department should be instructed to see that this valve is shut at the close of working hours. At times fires and explosions have occurred in gas soldering systems due to soldering flames being left burning and main gas supply not being shut off before blower is shut down. This can be avoided by proper supervision of gas valves and installation of proper wire gauze fire arresters.

Lacquering is a finishing process, lacquer being a metal varnish, composed of a resin or some pyroxylin product, dissolved in a solvent such as alcohol or benzine. The chief hazard in lacquers is due to the fact that they are extremely inflammable in themselves, also give off inflammable vapors at ordinary temperatures and these vapors also form explosive mixtures with air. Japanning and enamelling are similar processes to lacquering, although in these cases the resulting coating is opaque whereas in lacquering the coating is transparent. Japans and enamels are composed of asphaltum or some sort of oil paint mixed with linseed oil or turpentine, thinned with benzine or some dangerous inflammable oil. The process of lacquering, japanning or enamelling is done usually by dipping the articles

to be finished in a tank containing the solution and then placing the articles in a dry box or oven to complete the process, forming a hard glazed surface. The hazard of these ovens is important, especially as the gases given out are usually composed of the lighter petroleum compounds, producing an explosion hazard. The ovens should be well constructed and arranged and care should be taken that proper ventilation is secured, with a flue to give a slight draft. Steam or electricity are without question the safest methods of heating ovens, but unfortunately open gas jets are frequently used, especially in small ovens and probably the reason more fires have not occured, where this condition exists is due to the fact, that only a small amount of vapor is present, and because a high grade material is being used, without much benzine.

Lacquering, japanning and enamelling can only be classed as hazardous processes and if at all extensive should be done in a detached building, arranged for the purpose. If not extensive, the process may be done in one of the main buildings, but in this case should be in a room well ventilated and arranged, also separated from the main floor by a good fire stop or cut off.

The process of electro plating is done in vats containing a liquid of the desired composition including a metal in solution. The articles to be plated are placed in the liquid and an electric current passed through the solution, decomposing it and depositing the metal on the articles being plated. There is no hazard of importance involved.

The process of polishing and buffing is a finishing process and consists of holding the article to be finished against a rapidly revolving wheel, the buffing surface being built up of layers of cotton cloth, various substances being used on the wheel such as beeswax and oil, etc. Considerable lint is thrown off, so the surroundings are liable to be dirty and the hazard is increased due to the oil present. Metal hoods should be used over the wheels and connected to a good suction blower system, and the dust and lint blown to a small detached dust house, or if it is desired to reclaim the metal dust in the lint, the blower should discharge into some form of water tank.

Having considered the different classes of metal workers, a few remarks will be given to processes and hazards more or less common to all and the first subject in this group is that of oils. The first group of oils to be considered are the mineral oils, obtained by the fractional distillation of crude petroleum, and the ones usually found in metal workers are the lighter products, benzine, naptha, gasoline and the heavier products or lubricating oils. Benzine, naptha and gasoline are used for cleaning, thinning varnishes, japans, etc., and their hazards are too well known to enumerate in this paper. The heavier products or lubricating oils are of a high fire test and therefore

non-hazardous, further their composition is not changed on exposure to the air and therefore they are not subject to spontaneous combustion. Pure mineral oils are excellent lubricants. The next group of oils is that of the animal and vegetable oils, such as lard oil, tallow oil, cod liver oil, cotton seed, linseed and olive oil. They all are different from the mineral oils, and are not stable, undergoing chemical change when exposed to the air, with some development of heat, which if confined and if inflammable material is present, results in fire. They are not volatile, so cannot be considered in the same class as the lighter petroleum products. This group of oils are found to a limited extent in their pure state in metal workers. Frequently trade lubricating oils are used, consisting of a mixture of the expensive mineral oils and some of the animal or vegetable oils and this results in an increase of hazard. Large quantities of oil should never be kept in the main buildings, but in a detached oil house, built for the purpose. There is no spontaneous combustion hazard if the pure and expensive mineral oils are used, but this hazard exists if animal or vegetable oils are used either in their pure or in a trade mixed oil.

In connection with the oil hazard, should be considered that of oily waste. Large quantities of cotton waste are used for cleaning machinery and this waste soon becomes dirty and oily and frequently fires have started due to spontaneous combustion in oily waste. On this account an ample supply of standard waste cans should be placed at convenient places around the factory. Proper care should also be taken of machine shop sweepings, as they contain oily material of various kinds, such as waste, iron filings and chips, sawdust, etc., and are particularly liable to spontaneous combustion. Even piles of damp oily iron chips have been known to heat up by spontaneous combustion, when the heat is confined and combustible material present.

Oil is used in some cases for oil tempering and hardening; the process consisting of heating the metal in some sort of a furnace, then dropping it while hot in an oil bath. This process is not particularly hazardous, because the oils used have a high flash point and there is little danger of setting fire to the oil by the hot metal.

Various acids are used in metal workers, for cleaning and for electro plating, but the only one of any hazard is concentrated nitric acid, which if brought in contact with fibrous material, results in so violent a chemical action, that sufficient heat may be developed to start a fire. This hazard is more pronounced due to the fact, that the acid is shipped in glass carboys, packed in sawdust and straw.

Crude oil or petroleum is frequently used for heating forges and furnaces, the oil being conveyed to the burners by various means, atomized at the burners, by air or by steam, and burned,

the jet of atomized oil being usually blown horizontally into the fire chamber. This process even if well arranged means a distinct increase of hazard and it is of vital importance that the supply tank be properly located and every precaution taken to prevent an uncontrolled flow of oil into the building. Some of the advantages of an oil fire over coal is that the fire is continuous and constant, is ready immediately, no time being lost in replenishing and raking the fire and waiting for it to come up, as is the case when coal is used. A description will be given of a well-known system, that installed by the Gilbert and Barker Manufacturing Company. In this system, the oil is pumped to a well designed burner under pressure, atomized by an air blast, the oil entering the furnace in the form of a spray. The apparatus consists of a rotary air compressor, and oil pump, storage tank, the burners and system of piping. The main supply of oil is put in the storage tank, which is buried at a convenient distance outside the building, underground, and both the tank and oil pump are located below the level of the lowest burner, so that it is impossible for the oil to flow into the building by gravity. The air compressor and the oil pump are connected by a chain, so if the air compressor stops, the flow of oil also stops, making it impossible to feed unatomized oil into the furnaces. The oil pump delivers the oil into the distributing pipes and any surplus, through a suitable relief valve, back into the storage tank, thus insuring a constant supply of oil under uniform pressure, regardless of the number of burners in use.

The National Board of Fire Underwriters have published rules for the installation of oil burning apparatus and these should be carefully followed, some of the important features being location and arrangement of the supply tank, the rules varying as to capacity of tank and conditions at the individual plant, but no installation is approved, where the oil can flow into the building by gravity. Further, the rules provide for a well installed pump and piping system to prevent leaks, and also arranged so that all oil will flow back to the supply tank when system is shut down.

Other than approved oil burning systems are found in practice which means an increase of hazard, especially if any large amount of oil is inside the building, which is the case in systems where the oil is pumped from an outside storage tank to an elevated supply tank inside the building and fed to the burners by gravity.

In spite of the increased hazard, oil systems have not been the cause of many serious fires, due probably to the constant presence of employees, where the system is in use and where leaks have occurred, they have been small and immediately discovered.

Mention has already been made of gas soldering systems, found principally in jewelry factories and frequently gasoline gas is made at the plant and used, especially if the cost of public gas is high. If gasoline gas is used, care should be seen that the installation is according to the rules of the National Board of Fire Underwriters, and the least hazard is obtained with those systems, which do not introduce liquid gasoline into the building and this is the type of system usually found in metal workers. In this system, the carburetor or storage tank filled with gasoline is located about thirty feet from the building and buried underground. Inside the building, usually in the basement, is located an air pump, usually operated by a system of weights and a mixer, all connected by a system of piping. In operation, air is pumped to the carburetor, over the surface of the gasoline and the gasoline gas obtained returned to the mixer in the building, where it is mixed with air in the correct proportions and delivered to the burners. The mixer delivers a uniform quantity of gas in the proportion of about 85% air to 15% gasoline vapor. Such a system, if well installed, does not mean any particular increase in hazard.

A process at times found in metal workers, is the manufacture of producer gas, which is used for heating furnaces or for combustion in gas engines as power. One well known concern, the Otto Gas Engine Company, manufactures a suction gas producer for use in connection with their gas engines. This suction producer is a simple apparatus to put the heat of anthracite coal in such form, that it can be used for driving a gas engine. The coal is burned in a smothered fire and a gas formed, containing fully nine-tenths of the heat in the coal, but the gas as it leaves the producer is hot and dirty; some heat is lost in cooling and scrubbing, but finally 80% of the heat in the coal is available for use in the gas engine. The plant consists of the producer, the scrubber and gas receiver all connected by piping.

The producer contains the fire, the coal being fed in at the top and consists of a heavy upright steel cylinder, lined with fire brick, with a grate at the bottom and a water pan called an evaporater or moistener at the top. Air is drawn in at the top, over the surface of the water in the evaporator, is moistened and the air and water vapor, pass down to the bottom of the producer, then up through the coal fire, where it combines with the red hot carbon to form the gas, which is piped from the top of the producer to a three-way smoke stack cock, which can be set to let the gas pass up the stack or to the bottom of the scrubber, which is merely a steel upright cylinder, partly filled with coke and constantly sprinkled with water, piped in at the top. The hot gas in passing up through the scrubber is forced by the coke to follow a very crooked passage, bringing it in close contact with the water, which is flowing down through

the scrubber. The water carries the ash and other heavy impurities in the gas down to a settling basin, at the bottom of the scrubber. The gas is cool and clean as it approaches the top of the scrubber, is then piped to the bottom of the gas receiver and in its slow passage through the receiver deposits any excessive moisture it may contain; the gas is then piped directly to the gas engine ready for use.

The entire apparatus is connected together and when in full operation, the pressure inside the apparatus is less than that of the atmosphere, preventing any leakage of gas to the outside, the air being drawn into the producer by the suction of the gas engine. However, a blower is required for starting the apparatus and for reviving the fire in the producer after a shut down.

We have no record of any serious fires or explosions in such gas producer installations, but the fact must not be overlooked that an inflammable and explosive gas is being generated, which is a semi-water gas, containing 25% carbon monoxide and 16% hydrogen. Care, therefore, must be taken that the apparatus is well installed and located in a well ventilated room. Under the rules of the National Board of Fire Underwriters, subject to the approval of the inspection department having jurisdiction, suction gas producers may be installed in certain places of the main buildings.

Pressure gas producer systems are more hazardous than the suction gas type, as the pressure inside the producer is greater than that of the atmosphere and these systems must be located in a building erected for the purpose.

A process frequently found in metal workers and which is being employed in a number of different ways is that of oxy-acetylene welding which is used for various kinds of welds and in repairing broken or cracked parts. In welding with this process, oxygen and acetylene gases are combined in a blowpipe to produce a flame of intense heat, 6,300° F., and by means of suitable valves in the blowpipe, the flame can be easily controlled in a small or a large volume. The welding is done by applying the flame to the edges of the metals to be joined and additional material of the same kind as that being worked upon, may be added to fill in or build up the section. This additional material is in the form of a rod or wire, which is so held by the operator, that the end of the rod or wire is at the juncture of the parts being welded together.

This process is also extensively used for cutting metals such as steel plates, structural steel, etc., and in these cases a jet of oxygen is directed upon a previously heated part of the metal, igniting the metal, which burns with great rapidity and a narrow clean cut is the result. The action is so localized and so rapid, that the heat does not spread and the metal on either side of the cut is uninjured.

Acetylene gas, the fuel used in this process may be obtained from a gas plant on the premises by means of the usual calcium carbide and water generator or it may be obtained in steel tanks, charged on other premises. These steel tanks are filled with asbestos saturated with acetone in which the acetylene is dissolved and compressed to a high pressure and in this way a large volume of gas may be obtained in a small space. These tanks are of convenient size and easily portable. The other gas used, oxygen, is occasionally maunfactured on the premises of large plants, but is usually bought in steel cylinders from concerns making a specialty of its manufacture. The arrangement of the welding apparatus depends on the extent to which the process is used. In large installations, the welding and cutting is done in a room arranged for the purpose and in these cases the acetylene is usually made on the premises and the generator should always be located in a detached building and installed in full accordance with the rules of the National Board of Fire Underwriters. The acetylene is piped into the part of the plant where the blowpipes are used with suitable back pressure valves installed. The oxygen tanks are arranged in the same room with the blow pipes.

The second type used is a portable apparatus consisting of an acetylene generator and oxygen tanks all mounted on one base, the entire outfit being on wheels.

The third type is the smallest and is made up of an acetylene tank and an oxygen tank mounted on the same base and readily portable.

The fire record of these systems has been good in spite of the hazardous properties of the gases used. Acetylene is one of the most inflammable and explosive gases known and forms an explosive mixture with air in almost all proportions. Oxygen, while not combustible, is dangerous as it is an active supporter of combustion, that is, it renders other substances combustible and makes gases explosive. However, if the entire apparatus is well installed and maintained no great increase of hazard exists, in fact the only case of accident of which we have record occurred in an industrial school, where the operator altered the apparatus, hoping to obtain better results of welding. An explosion occurred with considerable local damage, the death of the operator and serious injury to his assistant.

In closing, will be quoted some statistics of the National Fire Protection Association in regard to fire record of metal workers with foundries omitted. The figures were published in 1908. Total number of fires 601, divided into 305 due to common causes or 51% and 296 due to special hazards or 49%, which is about the normal proportion for low hazard manufacturing risks. The most important special hazards were as follows: japan ovens and japanning 57 fires, furnaces 46, buffing and polishing 29, forges 22.

The most important hazard in the entire class is the furnace hazard, including that of forging, and next to that is the finishing hazard; if these two groups of hazards are further safeguarded improvement will be made in the record of the class which already is an excellent one from a fire insurance standpoint.

Automatic Sprinkler Protection

BY

F. C. MOORE

Automatic Sprinkler Protection

There is no sub-division of fire protection which has attained the importance to the property owner of automatic sprinkler protection and to none has so much practical recognition been accorded by the fire insurance companies by reduction in fire insurance rate. The merit of the idea having been recognized early, the subject became the goal of many experimenters and investigators, until the details of installation and use of the system have been quite well worked out and there is a mass of reports on the minutiae with little or nothing dealing with the subject as a whole in a logically progressive way which would give a fair understanding to a layman and it is the aim of these articles to do this as well as possible in the limited space available. The principal interest of most people is in present day methods and that will be our guide, with only brief reference to the historical.

An automatic sprinkler is a peculiar water valve which opens when the solder fuses which holds the valve closed. It melts at a certain definite temperature, ordinarily about 160° F., by the heat of the surrounding air which a fire quickly raises to the necessary temperature. These sprinklers are screwed into fittings in water pipes placed throughout a building at the ceiling in an arrangement intended to provide for the distribution of a shower from the sprinklers so that any fire in the building will be extinguished or controlled by the operation of the sprinklers. The installation of sprinklers is governed by a set of rules, in special cases supplemented by the judgment of an insurance inspector, and it is so difficult to become intimately acquainted with all the conditions that it is inadvisable to entrust the work of sprinkler installation to any but him who possesses experience in it.

The subject of automatic sprinkler protection includes not only the results of that protection but also the consideration of the efficiency of the apparatus and devices and their limitations, the installation under varying conditions, the water supplies, auxiliary devices associated with sprinkler systems, and a host of indirect relations which can not be treated here.

The idea of making the heat of a fire automatically operate some kind of fire extinguisher is known to be nearly two hundred years old. In 1809, Sir William Congreve patented a system of perforated outlets, the water supply controlled by combustible cords and three years later substituted a cement fusible at 110° for the cords. Nothing practical came of it.

Major A. Stewart Harrison, another Englishman, invented a system in 1864, including a sprinkler head using solder, but without practical success.

The real beginning of the idea that has developed into automatic sprinkler protection was when perforated pipes were put into parts of cotton mills in Lowell, Massachusetts, about 1852, the method having been used in England. From this beginning the development was continuous though slow until Parmelee's sprinkler more than twenty years later gave the impetus never since lacking.

This perforated pipe system consisted of pipes fastened to the ceiling at regular intervals, drilled with two rows of 1/10″ holes each row to one side of the top of the pipe, the holes 16 or 18 inches apart in the row and staggered so that there was a hole in the pipe every 8 or 9 inches. These pipes were connected to the supply main in sections, each controlled by a gate valve. When a fire was discovered, somebody opened the valve and water issued all over the section. The pipes were proportioned and graduated according to the area of the holes supplied.

At first it was put into the picker rooms only, the most hazardous part of a cotton mill, then into carding and spinning rooms also, and in 1859, they were required in the Lowell mills in these parts and in other places where special protection was deemed needful. Comparatively few mills were completely equipped.

The system was improved. They bored more holes, varied their location and size, inserted a non-rusting plate bearing the orifice and finally substituted for perforated pipes solid ones with spray nozzles or roses at regular intervals, each protected from dirt and vapors by a loose fitting tin cap that was blown off by the water.

The holes were stopped up with dust, rust, sediment, or filled with paint. Every little while a valve would be opened by accident or with malice. When the fire came they didn't always guess the section right; always they turned on the water over a much larger area than was really needful at first and this taxed the water supply too severely. The system was fundamentally objectionable because it was not automatic. All these defects came to be realized, hence, ultimately, Parmelee. Yet in the thirty years of their active life these systems put out many fires and many times failed to do so.

The first practical success with sprinklers was in this country. Henry S. Parmelee of New Haven, patented an automatic sprinkler August 11, 1874, which had a slotted revolving cap to cut up the stream into fine jets and this was covered by a cap held to the base of the sprinkler with solder melting at a low temperature. About 200,000 were installed before anything better was invented and they put out many fires and awakened general interest. This sprinkler was slow in action because the solder joint was on the body of the sprinkler where the metal was in contact with the water inside so that the cooling effect of the water had to be overcome by the heat before the solder would fuse. The sprinkler was modified to diminish this defect. This particular objection appears to be the reason for the invention of the present type in which the parts on which the solder is placed are held away from the body of the sprinkler and have such small area of contact with it that there is no appreciable cooling effect from the water or the mass of the sprinkler casting. This is well illustrated by the fact that a sprinkler fusing at 155° F. remained several hours without fusing in a fitting filled with water maintained above 200° F.

The first of the modern automatic sprinklers was invented in 1882, by Frederick Grinnell, and though this particular pattern is not now being installed, it is in principle like the current types having the valve held by a lever with fusible joint out of contact with the body of the sprinkler, a serrated disk to cut up the stream and an orifice about ½ inch in diameter.

Other sprinklers of the same principle followed close upon this one. Not one of this early period has stood the test of usage without material improvement in design. Most of them have long been out of use. Only one of the old names is represented among the moderns. Altogether more than 450 automatic sprinklers have been patented but only thirteen are now on the approved list. A mortality greater than that of modern warfare. No captive of the Indians ever ran such a long or deadly gauntlet as these sprinklers, which raced down the long lane of years lined both sides with eager underwriters, earnest engineers, inspectors armed with theories, facts, wild guesses, all taking a hack at the fast thinning file of sprinklers the leaders of which may be supposed to have plucked up courage as they ran unharmed, only to stagger with dismay at the sight of the Underwriters' Laboratories on the goal end of the line armed with every damnable weapon the others had overlooked. All hail the survivors!

An acceptable automatic sprinkler must be strong, tight under high and variable water pressures, able to distribute a definite amount of water in a uniform shower over a satisfactory area, manufactured to standard gauge, set up to uniform stress and be incapable of having its adjustment changed after com-

pletion, able to withstand corrosion and coating tests without disabling, uniform in fusing, to name some of the necessary qualifications.

At this time a sprinkler which is submitted for approval must possess these qualities:

Twelve gallons per minute discharge at 5 pounds pressure.

No leakage at 300 pounds water pressure.

No leakage under variation from 0 to 300 pounds water pressure repeatedly applied.

Fusing point of small variation.

Complete, snappy opening under no pressure. Open one.

When 4 to 6 inches from smooth ceiling must under 5 pounds pressure wet the ceiling over an area 3 to 4 feet in diameter and throw 90% of the water into an area 10 feet square directly beneath and 75% under 50 pounds pressure with uniform distribution.

The water must be cut up into fine drops and the parts must not materially interfere with distribution.

Sprinklers under examination are tested a great many times and for long periods of time.

The leakage test usually shows seepage around the orifice at 600 to 1860, average 1,009, well above the minimum requirement of 300 pounds.

For fusibility they are tested in an oven of definite design, under a 5 pound pressure, the temperature increasing a definite amount each minute. Under this test a sprinkler of 160° F. fusing point opened in 5½ minutes at 256° on an average. The test conditions are always the same, otherwise the results could not be fairly compared, which is true of any tests. The present conditions of test are those handed down from the early days of testing and which cannot be changed without losing the benefit of comparison with what has been done which is probably why they persist. The oven test is slow, about six sprinklers an hour being the rate.

They are also immersed in hot fluid, water for ordinary heads, lard for those fusing at higher temperatures, and are submitted to the intermittent action of a flame.

To determine the influence upon their operation of corrosion or coating they are tested after subjection for weeks to the action of the fumes of different strong acids, chlorine, ammonia, sulphur, and after coating with such materials as oil paint, whitewash, shellac and asphaltum.

The sprinklers are subjected to blows and the soldered links to long continued stresses. The factory methods of their manufacture are carefully examined, especially with a view to uniformity, and the makers are now using templates and limit gauges that permit only minute and unimportant variations. Since 1901, the testing of sprinklers for approval has been done by the Underwriters' Laboratories, Chicago.

Without discussing the details of automatic sprinkler design, a general explanation of the functions of the different parts of a sprinkler will make plainer the limitations of the device and how improper handling or location affect it. Selecting an example at random, the illustration shows the principal parts to be a stout frame with ¾ inch thread so it can be screwed into the pipe fitting and having a finished outlet for the water, a distributor or deflector plate fastened to the frame opposite the outlet, a valve disc of a material which cannot be stuck to the seat by corrosion, levers bearing on the valve and the frame and always under stress tending to make them fly out but held fast by some form of a pin or link kept in place by a low temperature solder. A fire occurs, the heated air melts the solder, the levers fly out, and the water issues.

Most of the metal parts of a sprinkler are of bronze, a strong yet not easily corroded metal. The solder and the parts it unites are the most vital parts and the most sensitive to adverse influences. Unless the solder fuses the sprinkler will not open and is then useless.

This solder is an alloy and the mixture used for ordinary conditions is in the proportion of bismuth 4, lead 2, cadmium 1, and tin 1, which melts at about 155° to 165° F., and this is the lowest fusing point obtainable without sacrificing other more desirable qualities. It has proven low enough. Twenty-five years' use on sprinklers yet in service has not developed any important criticism of this solder or shown any undoubted reason that it will not hold its strength and fuse properly.

There are places where sprinklers must be placed in which the temperature rises higher than ordinary, such as in dry kilns and over furnaces. For use in such places sprinklers are made with solder fusing at 212°, 286° and 360° F. To enable the different degrees of high test heads to be distinguished at a glance it has for some years been required that the frames shall be painted a distinctive color for each different fusing point, white for 212°, blue for 286° and red for 360°, but there are so many high test heads in use that were made before this scheme was evolved that the absence of color is not conclusive evidence that the head is of low fusing point unless it is certain the risk was equipped after the adoption of the color scheme. It is the practice to use a sprinkler fusing at a temperature not less than 60° higher than the highest temperature reached at the place where the sprinkler is to be placed, but with that limitation to use the sprinkler with the lowest fusing point permissible. It requires a longer time to fuse a sprinkler the higher its melting point, hence fire has longer to burn before water reaches it, and therefore none of the high test heads, as they are often called, is used except when absolutely necessary, and when

the occupancy of a place changes so that they are no longer needed, they should be removed and low test heads should be substituted.

To show the difference in time required to fuse sprinklers of the different melting points, the following quotations are made from standard oven tests:

Degree of Sprinkler	Distinguishing Appearance	Fused at	Time Elapsed.
165° F.	Not colored.	255.9° F.	5′ 34½″
212° F.	Frame white.	285.8° F.	8′ 37″
286° F.	Frame blue.	369.2° F.	16′ 56″
360° F.	Frame red.	505.2° F.	30′ 30″

The actual time elapsing from the start of a fire in a risk to the opening of the first sprinkler varies with the conditions of the fire and the place. Some fires quickly grow, others smolder; some places are low ceiled and the air is still, but others are lofty and draughty. Under ordinary conditions, the elapsed time averages about a minute. That it is short enough to give a high degree of efficiency in extinguishment the record proves beyond question.

The amount of water from a sprinkler per minute is approximately:

15 gallons at 5 pounds pressure,
19 gallons at 10 pounds pressure,
24 gallons at 15 pounds pressure,
31 gallons at 25 pounds pressure,
40 gallons at 50 pounds pressure,

though it varies slightly in different sprinklers. Assume that 75% of the water discharged from a sprinkler at 50 pounds falls within an area ten feet square, which equals an average depth per minute of .48 inch. Compare that with the most violent rainstorm ever recorded in the government station at Hartford, averaging .076 inch per minute. In other words, the sprinkler would throw 6.3 times as much water. To put it another way, a sprinkler at 5 pounds pressure would throw more than twice as much water as the record rainstorm. This makes it more apparent why no fire can grow under a sprinkler in working order unless it is sheltered by some such umbrella as a bench, table, pile of boxes or barrels, or some similar obstruction that keeps the sprinkler rain from the fire.

The sprinklers are screwed into fittings in pipes which are run throughout the building so that every nook and corner may be protected and every fire extinguished in its incipiency, which is a vital principle. Formerly this inside pipe was wrought iron but now it is practically all of soft steel and this material is now said to be of equal or greater resistance to ordinary corrosion than wrought iron, though experts differ. A life insurance

company owning a large building in which the sprinkler pipes were to be concealed is said to have ordered wrought iron piping, for the sake of durability. The pipe system is connected to its water supplies and the system is ready for use. All this is a matter of time and coöperation among several organizations.

In the earlier days of sprinklers the interest of the property owner in this form of protection was awakened by the earnest personal solicitation of the traveling representatives of the sprinkler companies. The installation rules had not been worked out by the insurance companies and the price was influenced by variations in the manner of installing. It was almost impossible for a buyer to tell whether the different bids were on the same basis or not. He could be reasonably sure they were not. It was hard to say one way was good and another was bad because nobody knew positively. Generally speaking there was no preliminary approval of detailed plans and there was sharp practice in sprinkler work. Under these conditions the public did not take the interest in sprinklers which their intrinsic merit warranted.

Soon the different insurance bodies formulated rules, varying more or less with each. The natural result was the movement for uniformity which, though not solely actuated by the needs of sprinkler systems, was principally due to sprinklers, and culminated in the formation of The National Fire Protection Association in 1896, an organization to improve the methods of fire prevention and protection. One of the first things they did was to draw up standard rules for the installation of automatic sprinkler systems which were gradually perfected until of late years these have changed only as new problems demand and comparatively few of those. These rules furnished a uniform basis which at once raised the standard of the sprinkler business, protected the property owner, increased the efficiency of sprinkler systems and gave a great impetus to the business of installing them. Today with the economy of modern industrial management and the dissemination of information by trades associations, no factory of important size, say of $75,000 or more in value, and many smaller is built without serious consideration of the saving in fixed charges to be obtained by sprinkler protection as a necessity of modern competition, to say nothing of the protection to the industry, and the same is true of mercantile enterprises, though in less degree. Henry Ford has recently made a condition that any plant having a contract to supply his company must be equipped with sprinklers to protect him against delay and loss from interruption of their production. This subject is also kept before the public by the distribution of well written advertising pamphlets and by extensive use of the popular magazines on the part of the sprinkler companies.

The property owner makes up his mind he wants a sprinkler system. His first step is to inquire about it of his fire insurance agent. If that agent is wise he gives him all the information he can because there is a competing agent waiting the chance to do it who will make it the means of getting the business and all the incidental business, too. If an owner asks for information he is entitled to have it and if the agent does not possess it he can get it by consulting some one of his companies which is equipped to furnish it.

The agent will obtain for his customer the services of an expert in the employ of some one of his companies if he desires to enjoy the advantage of a discussion from broad experience of all the points to be considered in connection with the particular risk, which gives the assured a full understanding of the problem before he commits himself to any part of its execution, oftentimes of much value. This expert can furnish a general plan for the fire mains and appurtenances and a list of suggestions in connection therewith which will serve as a sufficient guide to any contractor. The plan and suggestions would be submitted for approval to the rating organization having jurisdiction, a step absolutely necessary for the protection of the assured in order that he may not spend money for improvements that were not approved and therefore did not receive the fullest possible reduction in rate. The company expert, having fully familiarized himself with all the facts, is in a better position to explain the matter to the rater than the owner himself and, furthermore, knows the practices and precedents of the rating organization and can therefore save annoyance to both parties as well as unnecessary expense without sacrificing efficiency, or the agent may call directly upon the rating organization for plan and requirements.

Having an approved plan and requirements the owner sends copies to the sprinkler contracting companies he desires to bid and each of these which wishes to compete will send a contracting agent to examine the risk and secure detailed information for making a contract price and submits its terms. After the owner has reduced the different bids to a common basis for comparison, not always an easy matter without expert advice, he awards the contract and the successful bidder then makes a working plan of the entire system showing the location of every sprinkler, pipe sizes, lengths, and the details of water supply, and submits it to the rating organization for approval before any work is begun. From the information on the plan practically all the pipe is cut and sent to the risk ready to be put up. At least this is the practice of the larger concerns doing this work. This greatly shortens the time of installation as compared with the old way of cutting all the pipe on the job besides being more economical.

Several weeks usually elapse between the signing of the contract and the arrival of the workmen and it is seldom that an ordinary system is completed in less than three weeks, and from that upward, dependent on conditions.

The work finished it is or should be inspected and tested by the rating organization and is usually inspected by at least one inspection bureau also. These tests try the capacity of the water supplies and apply not less than 150 pounds water pressure for two hours to the mains and the sprinkler system by the application of a hand pump if no handier way exists, but where a fire pump is connected this is used for the purpose. If the system is tight it is considered satisfactory so far as strength is concerned. It is further necessary to examine the system throughout to be sure the sprinklers and other apparatus called for have been provided in the proper number, location and of the proper type. If all is correct the system is approved and the contractor is enabled to collect the balance due on his contract, usually one-third, the previous payments being as a rule one-third when the work is begun on the premises and one-third when the water is turned on.

These systems had to overcome the prejudice of people who feared the piping would mar the appearance of an ornamental building but there is little objection on that score now. The piping is not noticed by the ordinary person as it is painted as near as possible to the color of its background in such locations. In fireproof buildings, when desired, the piping is embedded in the floor arches or run in the space behind suspended ceilings, and only the sprinkler heads show. Some ceilings have been designed with little rosettes in regular rows and the sprinklers project through these ornaments so unobtrusively that there have been cases where insurance inspectors have reported that such rooms were not equipped.

Besides all sorts of buildings, vessels have been equipped, completely in some of the Sound and Great Lakes steamers and only in certain portions of the transatlantic Imperator. The finest department stores as well as the roughest factories, hotels, schoolhouses, car barns, all are commonly considered as suitable subjects for equipment, and there is hardly any type of building into which equipments cannot be put, though there are some kinds where their efficiency is quite reduced on account of the occupancy.

Owing to faulty workmanship by local plumbers and pipers of factories who were not skilled in sprinkler work, endangering efficiency and requiring expensive changes after the sprinkler systems were supposed to have been finished, with great annoyance both to owners and insurance authorities there grew up a strong feeling of opposition to the sale of sprinklers for use by such people which was shared and fostered by the established sprinkler companies not altogether disinterestedly. It culminated in

the passage of a resolution in 1903, by the National Fire Protection Association expressing the opinion that automatic sprinklers should be installed by the recognized automatic sprinkler companies and discouraging installation by others. The principal sprinkler companies did then refuse to sell sprinklers for installation by others so far as possible and this undoubtedly reduced the troubles at which the measure was aimed but so far as it prevented competent workmen from obtaining sprinklers it was inequitable and today there are approved sprinklers which are sold for installation by others under a licensing arrangement intended to insure the selection of skilled pipers. The writer has seen no evidence of the general existence of bad workmanship by reason of this plan, which has been operative about two years, but its success depends on close watch by the licensers.

In connection with sprinkler installation there is always carpentry to make holes for piping through floors and partitions, trenching for the mains, mason work in piercing foundations and other walls, besides cartage. These can be included in the sprinkler contract but it is practically always more economical for the owner to do these things, because he can often get labor cheaper and the sprinkler contractor who may be unfamiliar with local conditions is naturally apt to make his estimate provide unnecessarily amply for unforeseen emergencies.

Before sprinklers are installed it is economy to consider whether any changes in the arrangement of the building are planned for the immediate future, for it is a waste of money to change partition arrangement, for instance, immediately after completion of the equipment, as it is bound to mean changes in sprinkler piping as extra work with all that implies. A little foresight would have arranged the sprinklers to provide in advance for that condition. In buildings that have been in use before equipping, there is apt to be preliminary work to be done to prepare for the system, such as repairing breaks in plastering or sheathing flooring over well holes, removing useless platforms or shelving thus saving the cost of sprinklers beneath. As a noteworthy instance of oversight we recently found a new warehouse, which it had been intended to equip even before the plans were drawn but in which the height from floor to ceiling was such as to permit room for two tiers of cases without any space above, but as 24″ clear space below sprinklers is required by the sprinkler rules for proper distribution of water, they could use the warehouse for only one tier of cases and had to build another warehouse solely by reason of this error in planning.

By the rules sprinklers must be upright, that is above the pipes, except where circumstances render a pendent position necessary. In early years they were pendent, but it became obvious that the water which could not drain out of the neck

of such sprinklers would freeze and burst the head. The first step was to make heads on *dry* systems upright because it was pretty sure to be cold enough to freeze in some part of a building where a dry system was necessary. Pendent heads persisted in wet systems even after this, but occasionally a building with a wet system in it, therefore a heated building, would be vacant over winter and unheated, and in the spring they would find most of the heads frozen open if they had not been thoughtful enough to unscrew each head to drain it, which is a great bother. Furthermore, sediment gathers in a pendent head more readily and also in this position they were more apt to be struck through carelessness. Therefore, upright heads were made the rule.

The deflector is to be 3″ to 10″ below the ceiling or bottom of joists. An intermediate distance gives the best results, but as pipes must be pitched to drain, the distance from the ceiling must vary. The heads on the opposite ends of a 60 foot line of pipe will be 3 inches different in level, the usual slant of pipe being ½ inch in 10 feet. In old times it was a common fault to find sprinklers on the end of lines crowded up between two joists so that the distribution of water from them was all but cut off, greatly to the loss of efficiency, but now there is little trouble of this sort, because methods of obtaining a slight uniform slant are exact and pipe hangers are more readily adjustable.

The necessity for equipping every part of a building has already been mentioned. In fact, if there are any spaces where fire can be sheltered out of reach of water from sprinklers that may mean a greatly increased loss, or perhaps such a mass of combustible materials that bad results from sprinklers are to be expected, perhaps even total losses may happen, therefor risks with these conditions are the least desirable of sprinkled risks.

Time will not permit detailed reference to the rules for sprinkler installation but a general reference to them is necessary.

Experience has determined that a spacing of about 10 feet between heads each way on a smooth ceiling is right, but there is some elasticity permitted to provide for less usual framing of floor timbers. Of late years considerable floor framing has been of beams 4 to 6 feet apart with spans from post to post correspondingly greater than formerly. This has often resulted in an increase in the number of sprinklers over the framing in regular bays 10 feet wide and not infrequently this additional expense for sprinklers by reason of peculiar framing can be obviated by planning an equally satisfactory framing of a spacing more economical in sprinklers.

Under joisted ceilings the sprinklers are spaced 8 feet apart in the direction across joists and 10 feet with joists and sprinklers on adjacent lines are not opposite but are staggered or alternated so as to cover the spaces between the joists better,

so that a fire safely sheltered in a channel between joists midway between two sprinklers on a line would be almost directly over the sprinkler on the line adjacent.

The determining point about spacing was to permit the heads to be as far apart as possible and control the fire on the ceiling. Under the permitted spacing the ceiling is not completely covered with water by any means, but sufficiently so to be safe.

There is one point not brought out by any rule or mention, which is that any beam or framing member that is carrying a heavy load such as a heavy press or safe must have sprinklers placed so it will be protected without question, even though the rules for spacing might not require them. If fire could weaken such a timber so that such a heavy machine fell, vital injury to the sprinkler might very likely result and the entire sprinkler system be at once put out of service with consequent destruction of the building. That beams may so burn for lack of sprinkler protection has been proven.

The sizes of piping have been increased several times, principally to decrease the number of sprinklers fed by the smaller pipes from ¾″ to 2½″ in size. This meant cutting down friction loss at the early stages of a fire, the important time, and increasing the efficiency of the water supply. It is not often that the capacity of the larger sized pipes is heavily taxed. The ¾″ pipe has always been, and is now, the smallest pipe used. Officially it was permitted to supply but one head, but years ago they used it for two. The 1″ pipe at first fed three, now only two; the 1¼″ pipe six, now three; 1½″, ten, now but five; 2″, eighteen, now ten; 2½″, twenty-eight, now twenty; 3″, forty-eight, now thirty-six. Co-incident with this increasing of pipe sizes there was an increase in the thoroughness with which a building was equipped so that the efficiency of a sprinkler system has been doubly safeguarded. A further detail of value in preventing undue friction loss is the reaming smooth of pipes after cutting, removing the rough edge left by the cutting tool on the inside edge of the pipe.

Bad Use of White Lead.

The object of the design of pipe sizes is to make sure that every sprinkler likely to operate will have a discharge equal to the minimum acceptable under the specifications, when the maximum number is operating.

The entire value of a sprinkler system depends on having the piping system remain in place on the ceiling, which is so obvious that the thought of its falling down may seem strange, but this has happened and the screws used to hold the pipe hangers must be not only heavy enough and so inserted as to hold under ordinary conditions but also under ordinary exposure to a fire. If a fire attacks a building from outside or, what

is similar, from some sheltered place inside, it may heat the hanger screws so hot that the wood is charred so that they pull out and allow the pipe to drop. The whole system of piping over a considerable area has come down more than once in just this way. The natural question is, how can it get so hot without opening the sprinklers and cooling the screws with water. You will recall that water is not thrown very far on the ceiling and it may not reach them. Furthermore, under the conditions assumed, an abnormally large number of sprinklers will be opened and therefore the discharge from each will be reduced. This subject is given due consideration by competent contractors today and is the subject of a rule which, however, does not cover all phases of the question.

The present rules require the supply main or riser for a sprinkler system to be located centrally, to reduce friction and provide more uniform distribution of the water and its size is determined by the largest number of sprinklers it feeds on any one floor. The consideration is that so far as any ordinary needs of water are concerned it will only be necessary to consider sprinklers on one floor because a fire is usually extinguished in the story where it originates.

All the water supplies are required to be connected at the base of the riser, with special exceptions. This is to get the control of the supplies at the bottom of the building where one valve can serve for all. Then in case of a break or at the close of a fire, the supply can be easily and quickly turned off. Formerly the systems often had the supply from the yard main coming in at the bottom, that from the tank on the top floor, sometimes two of them. Consequently when the water was to be shut off, two or more valves at opposite extremes of the building had to be shut, there was delay, frequently no ready means of reaching the tank valve, and even it was forgotten in the confusion to close one valve.

To join together so many pipes a great many fittings are necessary, that is, cast iron hollow pieces of the necessary different shapes threaded to receive the ends of pipes and sprinklers. These are important parts and must be made of a fine grade and of high strength, otherwise they will contain imperfections that cause leaks all the more annoying if minute and hard to find or they will break. When strain comes on sprinkler piping it is usually exerted through considerable leverage on some fitting which by nature is less well fitted to stand it than the ductile pipe, hence it is very important to have the best of castings.

For proper control of the water supplies and for the subdivision of a system to agree with the fire cut-offs a considerable number of valves is necessary, though it is always desirable to have as few as possible for the simpler the control the less chance there is of a vital mistake in the use of them in emergency.

Those for the positive control of the water flow are gate valves, that is, essentially a bronze disc sliding in guides of the same material right across the pipe, something like the gate in a dam. The general arrangement of an ordinary valve is familiar to most people, but valves for sprinkler systems have been proven to require some means of indicating whether they are open or shut, in order to safeguard against being wrongly closed, which makes a system inoperative. The only valves without indicators of some sort are the very small ones and those in the street or some similar location that must therefore be buried in the ground and not allowed to project. For inside piping the best type is the outside screw and yoke valve, named from its appearance, in which the stem protrudes beyond the yoke when the valve is open and does not protrude when closed. There is a formerly much used type called the traget indicator, in which a sliding plate uncovered the words "Open" or "Shut" as the position of the valve required. This latter type of indicator is less certain and less strong than the other. Violent partisan warfare was once waged over the relative merits of the two.

Where the valve is underground a cast iron post is bolted over it through which runs a wrench rod to a nut on the top of the post above the ground and the rod carries a target indicator read through a glass inserted in the post casting. These post indicators are made of different lengths, to bring the top about 3½ feet above ground, a total length of 9 or 10 feet up north to 4½ or 5 feet in the warm countries. There has been much trouble with post indicators. If improperly bolted to the valve the frost heaves them, lifting the wrench off the valve nut, and then the target indicates but it does not mean anything because the valve does not move. The post may not drain properly and if the valve stuffing box leaks, the water will surely freeze round the wrench rod in severe cold weather and the rod cannot be turned. Then you dig the post up. Zero weather perhaps and five feet of frost, a nice job. They have been know to get indicator targets threaded wrong for the valve, then the sign says "Open" when it ought to say "Shut." The inspection of a post indicator valve ought always to be careful and especially at the first inspection after installation, absolutely convincing, which means that the valve must be closed and the inside drip tried and gauge pressure examined and then opened and the same things done, and comparison made to determine that the target actually meant what it said. For lack of a proper test such valves have been closed for months without detection and the sprinkler system consequently useless.

Whenever possible the outside gate is the only one used, because it is easily accessible even if the building is on fire, whereas if there were also or only an inside valve this might be shut by accident or for repairs and be inaccessible so that

it could not be opened. An outside valve must be placed where it cannot be made inaccessible during a fire, either by falling debris or by exposure, for it is absolutely essential to be able to shut off the water when the system is wrecked or overtaxed in order to conserve the water supply for the protection of other buildings.

It is necessary to keep all controlling valves always free from obstruction so that they may be operated quickly. In case of a break in the system any delay in shutting the valve means a greatly increased water loss. A recent case of seven minutes' delay cost $3,000. At that rate delay comes high. If a valve is hidden behind a pile of cotton bales or cased goods, it might require half an hour, perhaps longer, to remove the stock in order to reach it even if men were available, and at night they seldom are, therefore it is obvious what an important matter this is. Though most valves of a sprinkler system are normally open, they are not examined to make sure of it when they are obstructed.

Nowadays the controlling valves are of one well understood type, but formerly there were some of a positively dangerous design. One such type was in use in a certain flour mill. It was a quick opening valve with sector gears inside the case which made the valve move just opposite to the ordinary one. When the lever was moved in the direction that opened ordinary valves it closed this kind and it fooled a good many people so that these valves were often found shut.

Even yet there are valves in use the handwheels of which turn to the left to close, just opposite to the most common sort, and a large proportion of those for underground pipe operate that way. They are often called "left hand" valves, but this is confusing because different valve foundries construe this term contrarily. Nowadays valves for inside work close by turning the wheel to the right. Every valve has an arrow on it pointing to the words "Open" or "Close," usually the former and the arrowhead shows which way to turn, to be found on the wheel or some other prominent place. With this explanation it is evident that one must not take it for granted in which direction a valve turns but must examine it to find out. This is impossible in valves underground where it is doubly important to be sure, because such valves almost always control very important sections of a fire system. A lack of these precautions has resulted in leaving the water shut off for long periods unbeknown. It is often quite a difficult matter to test the condition of an underground valve conclusively.

The other kind of a valve which is commonly used in a system is a swinging check valve. This permits water to pass in one direction but prevents it from passing in the opposite way. In principle it is a bronze disc swinging against an inclined seat, and cannot be controlled by hand in the type now in use,

but acts automatically. Such a valve is placed underground at the point where each supply comes into the general system and the object is automatically to confine to the system any water put into it. The reason for this is that without shutting off any supply it is often necessary to maintain for fire use a pressure in the system higher than exists at the time in the mains of some of the supplying systems. In the extreme case, that of a break in the supplying system it might not be possible to maintain any pressure in the private mains until the gate valve between was shut, which requires considerable time, if it were not for the check valve, which acts instantly automatically. The maximum value of the check valve is evident when it is considered that such a break might occur, yes, has occurred, at the same time a fire started in the risk.

Usually the only thing that puts a check valve out of service is something that comes through the mains and sticks under it so as to prevent it from closing, such as a block of wood or stones. This is not an unusual happening in some systems. The obstruction can be removed by taking off the bonnet but this means excavating to the valve. To prevent digging in such cases, check valves and gate valves in underground pipe are frequently placed in a manhole, convenient but expensive.

Everybody understands that a sprinkler system is useless if the water supply is shut off, yet a good many gate valves are found closed, most of them from forgetfulness after some necessary repair job is completed. Every little while a total loss occurs because of this. Consequently it is the constant aim of the inspection bureaus to detect and guard against this error. Most of them practice sealing valves open, that is putting a wire or band through the wheel and around the pipe and securing the ends with a seal press so that the valve cannot be closed without breaking the band, which bears an identification tag that is expected to be sent to the bureau if the seal is thus broken, whereupon the bureau investigates and should make sure that the valve is opened again. This plan does some good but, as practiced, not what its ardent admirers profess to believe, because the man that needs the supervision most is the one that doesn't get it as he will not take the trouble to send in the tag. It would be quite feasible to issue numbered tags and check them up in such a way that the removal of a tag valve could be incontrovertibly established and the record for each risk made so plain that no property could afford to ignore it or fail to decrease such vital carelessness on the part of his management.

Some advocate straps with locks, instead of wire, because straps can be cut in emergency more readily than wire and they even hang a knife at the valve. The principle is the same.

Automatic Sprinkler Protection

Second Paper

BY

F. C. MOORE

When all parts of a building are so warm that water will not freeze in the coldest weather, it is expected that water will be kept in the pipes at all times and no provision is made for any other condition, and this is known as a "wet" system. There are many buildings where water would freeze in winter, such as foundries, saw mills, many warehouses, or perhaps only parts of buildings such as show windows, coal bins, attics, shed additions. Unless it is feasible to provide heating, the system in such places must either be shut off in the winter or special devices installed so that the pipes will be empty until a sprinkler opens and then water will be admitted automatically. A system maintained in this latter manner is called a "dry" system.

The method is to put into the supply main a device called a dry valve, the object of which is to act as an automatic water valve which opens when the air pressure pumped up in the system is reduced by any opening, normally of course by the opening of sprinklers. It is so designed that a given air pressure will counterbalance about six times as much water pressure, that is, at the customary working pressures.

Dry valves accomplish their purpose by the principle of differential areas, that is, the surface of the air side of the valve is enough larger than that of the water side to balance as desired, or a system of levers produces the same result. Obviously there must be no corrosion or other influence to cause such a valve to stick, and a slight sticking may be so multiplied in effect by the leverage that it will prevent the valve from operating. Therefore, these valves are carefully designed to avoid any such trouble.

To equip a dry system requires especial care from the beginning. The sprinklers are tested under air pressure, the piping is put up with greater care and the greatest care taken to see that all parts are arranged to drain back to the main riser. In addition to the dry valve an air pump must be provided and it should always be a power pump, for getting up 40 pounds pressure with a hand pump is a backbreaking job that a mechanic learns to sidestep soon. As neglect to keep up the pressure

results in the tripping of the dry valve and entry of water which may quickly freeze and burst piping, it is worth while to make the pumping easy, as most systems will need pumping once a week, though they should not lose more than eleven to fourteen pounds air pressure in that time, and many of them will not lose so much.

A dry system costs more per sprinkler than a wet system, not only because of the additional devices, but also because of the greater care in installation and the possibility of being obliged to make painstaking tests of the system to detect minute air leaks, sometimes requiring days going over joints, castings and heads with soap solution in which the leak will blow plainly visible soap bubbles. Before going to this trouble, however, the pipers admit water to the system so that as many of the leaks as possible may be closed by rust. Of course the larger leaks will allow water to issue but air will leak where water cannot pass, and it is this characteristic that makes the extra care so necessary.

It is better to put a dry system into a cold place than to shut off the sprinklers there in cold weather. Nevertheless, the dry system has marked disadvantages compared with the wet system and should never be used when it can be avoided.

To begin with, there is the delay while the air pressure is decreasing, the valve tripping, and the water coming. This is not the principal disadvantage. The time consumed is ordinarily about 45 seconds to one minute but may be a little less or as much as two minutes or more, according to circumstances. On a wet system water issues the instant the sprinkler opens.

The principal disadvantage is undoubtedly the interruption to service that comes from the necessity for repairs to the valve, from difficulty in setting it properly when it trips, from damage from freezing when the air pressure is not properly maintained and water enters.

Furthermore, there is a chance by no means infrequent that some part of the system, from a few heads up to 36 or more, will be out of service because of ice in the pipes.

Finally, the dry valve may become inoperative from corrosion or deposits from the water, in which case the whole system will be shut off. It is only fair to say that but few cases have been proven to occur in time of fire.

A dry valve is often very troublesome to set when it trips and this often results in leaving the system shut off over night. The seats are easily marred by improper handling, so that they leak and the valve then has to be sent to the makers for repairs. A flanged pipe is expected to be kept on hand so that it can be put in place of the dry valve to make the piping intact

and permit the use of the system in emergency by opening the gate valve. This precaution is more honored in the breach than in the observance.

If the air pressure gets too low and the valve trips, in winter the water is likely to freeze before the system can be drained, especially if the trouble occurs at night. Then pipes or fittings burst and the system must be shut off till repairs are made. These are not infrequently unnecessarily delayed.

In many of the dry systems in winter and at any time in those in low temperature cold storage rooms, ice may form so as to close completely pipes up to 4 inch diameter as practice shows, but usually the smaller pipes are the ones affected. Such a plug of ice cuts off the water supply from sprinklers beyond it and thus leaves some section without sprinkler protection. Some recent investigations have shed interesting light on the presence of ice in dry systems and special reference to this subject will be made elsewhere.

The dry valve may become stuck fast so that it will not open at all, in which case that particular system is absolutely shut off. I have not been able to learn of many cases where, after the fire, this has been proven to have happened. There have been quite a number of cases where test has proved the dry valve to be stuck, but generally speaking, inspection organizations are ignorant of the condition of dry valves because they do not test them by tripping them. The makers of the valves recommend that they be not tested but merely examined through the hand hole, because an unskilled person has trouble in resetting the valve and may damage it, furthermore, it is hard to drain any system completely and practically impossible to drain those where piping has sagged without disconnecting pipes at that point.

Therefore, many a dry valve, if not tripped by reason of fire or accidental leakage, remains for years without operating. This is the most difficult condition for any mechanical device, to leave it motionless for years without use of any kind and then suddenly call upon it to perform its normal function. Even the human body, that most perfect machine, will not stand that test, as evidenced by the rigid, immovable arm or leg of an Indian fakir. When dry valves fail it is usually due to rust or deposits from the water in places where they prevent the valve from moving.

Dry systems give less reliable protection than wet systems and grading schedules have a defect charge for them. If there is any error, it is in not penalizing them sufficiently. There was recently published a comparison of efficiencies of the wet and the dry system obtained by a comparison of the N. F. P. A. statistics. It is not of much value in regard to comparisons of losses because the information concerning the amount of losses was altogether too vague. Every loss up to $5,000 was called

a "small loss" and every one above that amount a "large loss" and that was as close as they tabulated. Most of the other comparisons are good. It shows that although the water pressure averaged a little higher at the fires under dry systems the average number of heads opened per fire was 11.97, or 1.8 times as many as on wet systems, which averaged 6.54, a showing undoubtedly due principally to the delay in discharging water from a dry system. In regard to extinguishing and holding in check fires, the two systems were about equal but of fires unsatisfactorily handled there were 6.4% under dry systems, a very marked difference to the disadvantage of the dry system. Strange to say, of fires for which no claim for loss was made the dry system showed 42.8% and the wet system 30.3, which is not readily explainable.

Notwithstanding the efficiency of sprinkler protection it should be supervised in operation to guard against abnormal conditions and prevent undue water damage and be backed up by the operation of hose streams and other manually operated devices, therefore alarm valves have been devised for sprinkler systems, each of them called into action by the flow of water in the sprinkler riser, resulting in ringing a loud gong usually placed outside the building, frequently with a second gong inside the building. The object is to give notice that the system is operating so that the watchman or some passer will investigate or call help, serving as a fire alarm or a leakage alarm, as the case may be.

It is interesting to note that Parmelee's system was under one plan arranged to blow the factory whistle by means of a cord attached to the movable parts of the sprinkler and in the 90's there was a thermostat combined with a Grinnell sprinkler in use, which operated from the release of the moving parts of the sprinkler to which one end of the thermostat spring was attached, or by the action of heat on the spring.

On a wet system the alarm valve is usually some form of a check valve placed in the main riser just inside the gate valve or as close to where the riser branches from the supply main as possible, for one important function of the alarm valve is to give notice when the water flow is due to an accident and it is therefore desirable to have it protect as much of the piping as possible. When water flows the check rises and this uncovers the inlet to a small pipe which leads to a chamber which the water fills after a few seconds exerting pressure on a diaphragm actuating a switch closing a gong circuit and also a part of the water flows through another branch of the small pipe to a little turbine water wheel that carries a tongue on the projection of its shaft, which strikes a gong. Some times both are not used, but the idea is to make an alarm doubly sure and not dependent solely upon the integrity of an electric bell circuit.

Annoying false alarms occur when water hammer causes pressure increases and especially after a system has been emptied for it contains a good deal of air which is gradually compressed or leaks out, when the entering water causes an alarm. To prevent these false alarms the retarding chamber referred to has a small waste hole proportioned so as to require an appreciable time to fill the chamber enough to exert pressure to close the switch, yet not delay enough to be vital in case of actual need. The tendency to give false alarms is increased by any manner of piping the drip from the retarding chamber which permits it to be clogged up or even partially obstructed and much of the false alarm trouble is due to neglect of these precautions. The end of the drip pipe from the retarding chamber should be open, then if it is clogged it will be detected and no water can back up into the chamber to close the circuit that way.

False alarms from surges in the pressure in the mains are sometimes prevented by pumping up a pressure inside the sprinkler system higher than any probable increase in the outside pressure. The alarm valve, being a check valve, holds this excess in the system and is thereby prevented from opening. The maintenance of the pressure requires occasional pumping and the desire to maintain it with the least trouble makes the owner unwilling to permit customary flow tests from drip valves.

One of the worst results of false alarms is that after repeated trouble some impatient mechanic will shut the alarm off altogether.

It not infrequently happens that no alarm will be given for small flows, such as that of one sprinkler. For these reasons some organizations do not require alarm valves, but, especially where there is no watchman, they are usually required. Except these limitations the worst accusation is that an alarm valve is another obstruction to water flow. When it is connected to a fire alarm system or central station system, false alarms occasionally call out the fire department to their great vexation. An alarm valve should be designed to permit flow without loss of pressure, to be free from sticking from corrosion or otherwise, to be sensitive to small flows and yet not give false alarm. Modern types are not perfect, but some of the older types, especially those with spindles projecting outside the valve casting, were a positive danger because the spindle would get stuck in the stuffing box and hold the check valve from opening. This sort is no longer made but occasionally one is found in service.

The dry valves all have provision for an alarm, some of which are operated by electrical contacts caused by the falling of the levers, and others by the flow of water in an auxiliary pipe as with wet systems, but if a dry system is allowed to have water in the pipes in summer then during such time the alarm must be put out of commission or it would ring continuously.

Because this practice is quite common an extra charge is made in the sprinkler leakage rate for a dry system.

In addition to the difficulty of adjusting alarm valves to the varying conditions even in the same risk, the electrical gong circuit gives trouble in many places from neglect to look after the batteries or injury to the wiring and the water rotary gong from sediment stopping up the nozzle in the turbine or some doughty sparrow building a nest inside the gong to prevent which the gong should be and usually is screened.

Notwithstanding the imperfections of alarm valves they are of value, more especially in risks where the watchman service is not good or entirely absent and alarms have saved much water damage. Out of 2,031 alarms tabulated from different sources, 840 were from the alarm valves, which gives some idea of their use.

The best system is useless if proper water supplies are not provided. In my opinion their relative value, all things considered is, municipal or large private water system, gravity tanks, pumps, pressure tanks, which broadly enumerates all the customary kinds. Possibly there may be some disagreement about relative order of importance. Although the possible need for a large volume at high pressure must not be overlooked, statistics show that 85% of the fires are extinguished by not more than twelve heads, therefore, it is obvious that an instantaneously available supply sufficient for a moderate number of sprinklers will take care of the majority of cases, but it must be ever ready, and so simple and easily cared for that it will always be in order, and the possibility of opening many more heads must not be overlooked.

A city water supply from gravity reservoirs of good pressure, in a city large enough to have a good water works organization and large, cross connected mains, is the ideal, giving reliability, pressure and capacity. From that, public systems vary down to those which might actually be of less value than a good gravity tank on the risk. Pressure alone under the ordinary local service conditions must never be accepted as evidence of efficiency. The ability to maintain effective pressure under draught at the risk equal to what would be made at time of fire is what must be established by actual test, before such a water supply can be approved. It is too often neglected. Beware the high pressures of the little town or village; capacity is often lacking. Pressures of 100 to 125 pounds will be drawn down to 25 or 30 pounds by two or three hose streams. The actual test detects closed valves, obstructed mains, and no study of plans or surface indications can ever be a safe substitute.

Of course there are gravity reservoir supplies that are of too low pressure or too poor pipe design to be good for sprinkler systems. Years ago in Albany I awoke thirsty about one o'clock

one night and found the water would not run on the third floor of the hotel. The investigation next morning developed that the city had been obliged by shortage of water in the reservoirs to close almost completely the valve for the whole mercantile portion of the city at night in an endeavor to save what they could. This lasted a long time, although they adopted additional precautions. There was not supply enough for fire engines until the valve was opened.

Many towns have standpipes which are filled by pumping. They are practically tall tubes of small diameter for their height which means that although the pressure when they are full is comparatively high, it may diminish greatly during the day or overnight on account of draught, if pumping is not constant. No such standpipe should ever be used, but if any such storage is necessary it should be in a large diameter tank elevated on a tower, if necessary, so that even if the tank becomes nearly empty, the decrease of pressure will be nominal.

Other town systems do not even use a standpipe but pump directly into the mains, everything depending on the pumps, which may be in a dilapidated wooden pumphouse in a frame range on the river bank, to select the worst type.

The public water system has one great advantage, that it will certainly be shut off the mains only for the shortest possible time if at all, because so much complaint will otherwise arise.

Gravity tanks combine cheapness and low maintenance with feasibility. They can usually be set up somewhere on or near every plant and when city water is not available, are almost invariably used. A common rule to estimate the size is to make the capacity that which would supply 20 gallons per minute for twenty minutes to one-quarter of the sprinklers on one floor, which amounts to 100 gallons a sprinkler for all the sprinklers on one floor, but a tank of less than 10,000 gallons is nowadays seldom erected. There is no minimum stated in the sprinkler rules, though local organizations may have one. A 5,000 gallon tank is a small one, as they go, and it has been years since I have seen a new one so small. Tanks of 40,000 and 50,000 gallons are quite common and we recall one of 100,000 gallons on a trestle 150 feet high. These large tanks practically always supply hydrants as well as sprinklers and for this dual use a 30,000 gallon tank is the smallest advised and it should be even larger. The exact details of tank installation are left by the rules to the local inspection departments.

Formerly the tanks were wooden. Those of moderate size are so built now in most cases. Steel is now generally used for the larger tanks. It is generally believed both kinds need painting at intervals for the best preservation. A wooden tank will always leak at first because the staves are expected to swell on absorbing water, hence the hoops cannot be tightened until

the wood has ceased swelling, as it does after a few days. Tanks may and have burst when the hoops were tightened too soon. If a tank continues to leak after it has had a chance to swell for ten days it never will become tight by that method and some defect will be found. Tanks cannot be allowed to leak for this is apt to cause decay of the supports and will result in the formation of heavy masses of ice on parts not designed to carry them and the ice may fall and maim or kill persons.

FLAT HOOPS — EXPANSION AND SWING JOINTS — TELLTALES

Most of the tanks are placed on top of the buildings they supply and in the heart of cities that is the only available place. The concentrated load is great and the strength of the building and its foundation must be ascertained to be sufficient before the tank is erected, otherwise the building may collapse and fatalities occur. For the same reason the condition of tank and supports must be watched during its lifetime and any weakness at once repaired. Some bad accidents of this kind have occurred. Even the steel trestles have rusted out and fallen and care should be taken that every part of a steel trestle is accessible for inspection and painting. On a match warehouse in St. Louis such a trestle was boxed up where it passed through the roof and in a few years rust reduced its area by two-thirds. It fell and the impact set the matches on fire which pretty well completed the destruction.

The gravity tank is simple, cheap and reliable with ordinary care. Its operating force, gravitation, is always on the job, which is a great point. In capacity and pressure the tank has to yield to some other supplies, but in ever-readiness and general adaptability it has all the others beaten. Where high initial pressure is necessary, as in a furniture factory, a tank is handicapped, and one of moderate capacity may be exhausted before the fire is controlled, but for the average conditions, the tank is the chief reliance of sprinklers.

Though not difficult to maintain yet it must be heated in winter, by hot water heater, open ended steam jet or return coil, or, less often now, by enclosing in a heated tower. It has to be replenished with water, most handily by a by-pass around the check valve, quite often by a separate filling pipe. Muddy water has to be kept out of it or mud will go into the sprinkler system though the most of it stays in the tank because the outlet pipe is required to project 4 inches above the tank bottom for this purpose. They took out several cart loads of mud from a large steel tank in Manchester. As there was no blow-off they had to draw it out in buckets and empty it over the side. It would have cost less to filter the water.

Pressure tanks were the outgrowth of a desire to obtain from a tank a heavier pressure than a gravity tank would provide and probably somewhat to the attempt to reduce the amount

of water in view of the high pressure. A pressure tank is a cylindrical steel tank, with its length horizontal, in service filled two-thirds full of water and the rest with air ordinarily at about 75 pounds pressure, connected from the bottom to the sprinkler system. When water is discharged from the system the compressed air, expanding, drives the water out of the tank to the sprinklers and under the conditions named, the last of the water will leave the tank at a pressure of 15 pounds which is a little more than the pressure on the top sprinklers from an ordinary gravity tank when full. Therefore the pressure tank at its lowest gives a slightly better pressure than the ordinary gravity tank at its best, assuming that the pressure tank is located on the roof as is usual, and understanding that this comparison would not be strictly true with large or exceptionally elevated gravity tanks.

These tanks were at first invariably of 4,500 gallons cubic capacity (3,000 gallons water) but they are now frequently 6,000 gallons and on large city risks 9,000 gallons. Beyond that size it is not economical to go. They are placed on the roof but are not elevated above it like gravity tanks since compressed air furnishes the desired pressure, not gravity, though the latter of course helps. They have been placed lower down in the building where more convenient, even in the basement, but this requires a correspondingly higher air pressure to offset the difference in elevation and such locations are generally unacceptable. Sometimes several are placed on the same risk.

It is a troublesome matter to maintain the water at the right level and also the air at the right pressure. It is common to find one or the other wrong. Owing to these difficulties and the limited capacity, a pressure tank is never considered as the only supply, but as an auxiliary supply with some other of more volume. They have to be well housed in a warm place and are considerably more troublesome than a gravity tank to maintain properly. Their most common use is with gravity tanks in cities where it is not feasible to use city water or pumps, as in New York. The pressure tank is the least used of all supplies for sprinkler systems and it is not advisable to use it where the other types are available. We have heard of only two explosions of pressure tanks, part of one being blown off the roof into the street by the recoil.

Pumps of various kinds are used when the motive power is available when there is no other supply of good pressure and volume. A pump is practically never used as the only supply for a system, because there is too much chance it will be out of full commission. The requirements for supplies to a standard equipment are that it shall have two, one automatic and one capable of furnishing water under heavy pressure. In my opinion no private fire pump is automatic to the degree of reliability the term demands in this connection.

The first type of pump thus used was the rotary, which may be briefly described as a pair of broad toothed intermeshing gears revolving in a closely fitted case, usually drawing in the water at the bottom and discharging it at the top, driven by a shaft. This method of driving was always available in any mill. At first, driven by belting, slippery or loose if wet and capable of burning off, then by gears sliding into mesh, not sufficiently flexible and breaking from careless usage in the excitement of the emergency, and finally by friction clutches of some sort, the perfected type being two V-grooved wheels face to face, that on the pump shaft moved into firm contact with the other by a hand screw — safe from breakage, but too slippery to transmit the necessary power if oil gets spattered over them, nevertheless best. These pumps often badly located under the floors in crowded half basements of the mills, convenient to the main driving shaft but likely to be completely disabled by the fall of the building, the difficulty of access resulting in neglect, they were frequently found out of order. Compared with other types, the wear is great. Never good for more than moderate lifts, wear soon reduced their efficiency in this and in their discharge.

Though perfected in design and capable of being installed to obviate errors of location and power transmission, their somewhat less cost does not make them effective competitors and comparatively few are now installed. Even where the rotary principle is desired the modern turbine centrifugal pump can usually be used and is preferred, especially for its adaptability to direct connection to electric motors, which the slower speed of rotary pumps usually forbids.

Turbine centrifugal fire pumps have discs bearing curved vanes revolving at high speed, imparting to the water a high velocity which is restrained by the shape of the passages and appears as pressure. Several discs are arranged on the same shaft, each in a separate casing with suitable water passages to the next, through which the water passes in series receiving added pressure from each impeller disc, usually about 45 pounds, such being a "multi-stage" pump.

Properly built they are simple, durable, not easily damaged. As the moving parts will not positively displace and eject the air in the pump, so as to produce a high vacuum, the pump will not lift well unless it and its suction pipe are filled completely with water — primed, as the phrase is. Thus they lack a quality possessed by a rotary in good condition and preëminently by a piston pump such as a steam fire pump, hence their location should preferably permit water to flow into them, sometimes difficult to arrange.

The turbine centrifugal pump is the latest. It is not yet widely used, perhaps because the customary combination with electric motor drive is expensive, the required arrangements for satisfactory supply and control of electrical power materially contributing to the cost.

The most used and, by that token, the best adapted type of pump for general use for fire protection, is the duplex, steam, piston pump. Using the most common and best understood motive power, slow speed, positive vacuum producing plungers, it is generally found in repair, durable, and prompt in action, having more advantages than any other at but little more cost than the present type rotary. Where steam of sufficient volume and pressure is available this pump is almost invariably chosen.

One of its comparative advantages, positive suction, is to some degree neutralized by the conservative practice of making the suction of any fire pump short and with a limited lift, to avoid the difficulties of maintenance of long lines of that sort. A very small leak will let in air enough to prevent the pump from drawing and a settling of the pipe joints may cause it.

In design they are especially provided with more liberal passages for steam and water than ordinary pumps, are heavier, better fitted to resist corrosion and will give a higher water pressure at a given steam pressure so that the water pressure will be effective even if the steam is low.

Fire pumps of all types are commonly made in 500, 750 and 1,000 gallon per minute sizes and less often in 1,500 gallon sizes, that is the delivery at 100 pounds pressure at the pump, 250 gallons per minute being considered a standard hose stream.

The 500 and 1,500 gallon pumps are seldom used. The 1,000 gallon size is probably most common and such a steam pump requires about 150 horse power boiler capacity to run it right.

Any fire pump can be made to give considerably more than its rated capacity under favorable conditions, but the rating shows what it must do under ordinary service conditions. All must have those parts made of bronze which are likely to rust and be designed to give high pressures under unfavorable conditions without much regard for economy of operation. A fire pump runs comparatively little and economy is not the prime consideration. Yet it is not uncommon to see a fire pump in use for continuous service supply, usually a wasteful procedure. It is no exaggeration to say that it would be far more economical in most cases of this kind to buy a service pump better designed for the needs, not to mention the advantage of not wearing the fire pump into a condition of ineffectiveness often not realized until urgent need demonstrates it too late.

With all types it is necessary to be careful that the value of the pump is not reduced by a poor arrangement of its supply of water, steam, electricity, driving shaft, suction and discharge

mains, and this must be carried back far enough to see that even by remote causes the pump is not vitally affected. Why throw away the use of an expensive installation because the only water supply to the boilers comes through a lightly built or hazardous building where it is broken down early in a fire or because an exposure fire can drive men away from pump or its sources of power? These illustrate two of many conditions that must be considered.

A comparison of results in a large number of fires has been tabulated according to the nature of the primary water supply, that is, the supply which will operate first. These supplies were. water works, 2,961 fires; gravity tank, 1,938 fires; pressure tank, 627 fires; and automatic pump, 256 fires. These correspond to the sources mentioned herein, except that of the pump which in the comparison is limited to pumps equipped with regulators so as to start automatically. The number of fires is sufficient to give reliable results in each case for most observations.

The percentages of fires "extinguished," "held in check" and "unsatisfactory" are nearly the same for the water works and gravity tank even though the average pressure was 66 pounds and 24 pounds respectively. Evidently 24 pounds average pressure was enough. The pressure tank showed 82.5% extinguished, 18 to 20% more than the other sources, the average pressure 91 pounds, or 25 pounds higher than any other. Inferences might be drawn more favorable to the pressure tank than I think would be warranted. Certainly the greater pressure is not responsible for it as a study of the results based on relative pressures shows. It is probably due to the more favorable conditions in the risks in which pressure tanks are placed, which are for the most part mercantile or light manufacturing risks of moderate size, good construction and moderate hazard. The pressure tank has the lowest percentage of "unsatisfactory fires," which is consistent with this belief. It does show without doubt, however, that pressure tanks have been successful, notwithstanding the difficulties of maintenance.

The automatic pump has the worst record, especially in the average number of heads opened per fire, also in regard to "unsatisfactory fires," 5.9% against 3.4%, 3.9% and 1.9% respectively for the others, but the element of chance is too great in this on account of the small number of automatic pump fires.

Grouping according to pressures which averaged for the four groups, 10, 19, 35 and 78 pounds, respectively, shows the average number of heads opened per fire to be 7.39 (5,782 fires) with only small variation in the groups. On the average 65.7% were extinguished. 30.9% held in check and 32.3% had no claim for loss. There is not much variation from the average except

that the lowest pressure group shows a notably larger percentage of "unsatisfactory" fires and lower percentage of "no claim" fires, consistently indicating a warning against low pressure.

The comparisons as a whole are interesting but on the same general basis comparisons should be made for several groupings of physical conditions and hazards of occupancy. The low percentage of unsatisfactory fires, 3.4%, emphasizes the efficiency of sprinkler protection.

A common emergency water supply is provided for in the so-called "steamer connection" which is a fitting projecting from the street front of the building or other convenient location, to which hose lines from fire engines can be attached, and connected by piping to the system inside the gate valves, so that water can thus be introduced even if the gate valves admitting the ordinary supplies happen to be shut. They are usually made for two hose lines and have inside a check valve that shuts off the idle inlet when a line of hose is attached to the other. Being close to the sidewalk, and of brass as good as gold in any junk shop, they present an almost irresistible attraction to needy street urchins and therefore must be pinned on to their pipe connections so as not to be removable with tools ordinarily obtainable.

Unfortunately there has been, and yet remains in many places, a strong objection by public fire departments to the use of steamer connections. There is no sound reason for this condition and it is changing. The Philadelphia fire department has for about two years made it a rule to take the first line of hose into the building and to connect the second to the steamer connection and there is recognition by others, but it should be given by all and the people, who pay both the fire losses and the expense of fire departments, should compel it. One line of hose thus connected is valuable and two lines can furnish as good a supply as the best that many systems have and the sooner they are connected the less the loss will be.

In the larger cities there are sprinkler equipments in basements only, which have no other means of supply than hose connections and they have been very useful in controlling in these comparatively inaccessible, and usually crowded, places.

There are certain types of sprinklers which are not automatic but have the general form of automatic sprinklers and are attached to piping in the same way, but have deflectors of a special shape according to their uses. Such are the cornice and window sprinklers placed outside these to prevent cornice or other combustible exterior trimming from igniting and windows from breaking from the heat of an exposure fire. On the old pitched wooden roofs it is quite customary to place a row of open sprinklers along the ridgepole and it is obvious how much better that is than the older arrangement of depending on the services of men with buckets clambering precariously along

a narrow ridgepole walk. A unique use of open sprinklers was to place them along the top of a rather high board fence next a lumber yard, as protection against the lumber yard exposure.

A cornice, wall or window sprinkler has a deflector shaped to throw all the water towards the building. These outside sprinklers must be turned on as needed for water cannot be kept in the pipes on account of cold. They cannot be readily replaced and therefore they are permanently open. They are piped in sections so laid out as to avoid the necessity of turning on any more than are necessary. In order to equalize the discharge to just enough for efficiency at the elevation where the sprinkler is located, they have orifices which are largest for sprinklers at the top, three sizes in all, and because there is no need for so much water as from inside sprinklers which must distribute the water on all sides, the largest orifice in open sprinklers is smaller than that of the automatic sprinkler and in the smallest size only one-quarter the area.

The piping supplying open sprinklers is run nowadays inside the buildings so far as possible, with branches extended through the window caps or walls. This puts the fittings where they are accessible and avoids the exposure of the piping to the elements so far as possible.

One of the worst foes to open sprinklers is scale and rust from the inside of the pipe, which washes into the head and stops the orifice, and this is the principal reason why galvanized pipe is required. It is not uncommon to have several heads in a section suddenly choked up by this or similar material.

In operation with an ample water supply a curtain of water is poured down which very effectively protects the windows and other exposed parts of an ordinary brick building and in combination with wired glass windows makes exceptionally good protection. They have one serious limitation, that they must be turned on by hand, which does not amount to much when the risk is in operation, but which is important at night with no one at hand and at such times fire has broken into a risk from neglect to turn on the open sprinklers. For this reason especially the public fire departments should be made familiar with the existing open sprinkler systems so that they will be properly handled at all times.

When the water supply is good, open sprinklers will keep ordinary window glass from breaking and make a good barrier against exposure fires, but to be sure of this requires a first class water supply, so many sprinklers must be open at once. One of the best examples of these principles was the Kilgore factory at Toronto against which the conflagration beat in vain. The exposure was close and so fierce that the face of the brick work was scarred noticeably yet hardly any window glass was broken

in the lower stories though the fire did get in at the top because the water pressure was not enough to give good open sprinkler service there, which was the only protection the windows had.

On account of the large amount of water required because so many open sprinklers must be turned on at once, pressure tanks are never connected to them and gravity tanks only when large increased capacity has been provided for that special reason.

There are no machines that require so little attention as a sprinkler system yet it will not do at all to assume that it can be forgotten after it is installed. Having acquired a sprinkler equipment, there are lots of "dont's" for the owner to observe which are new to him, and more of the troubles of maintenance are caused by omissions than by direct damage.

One of the most difficult things to impress upon many is that the value of a properly installed system may be seriously affected if subsequently obstructions be put up, such as hanging shelves, large benches and continuous tables, partitions, ceilings, unless the sprinkler system is extended into the sheltered spaces thus formed.

Another fault is the coating of the heads with paint, bronzing or whitewash used in finishing the building or the pipes. Especially is this likely to happen when the material is applied with an air brush, as is often the case with whitewash. Then it is necessary to put little bags over the heads temporarily and sometimes the bag is on a pole held by one man while the other sprays. These or any other coating on the movable parts may cause the sprinkler to stick fast.

The solder of sprinklers is vitally subject to corrosion from acid and other fumes, most rapidly in damp places. This is also true of piping. It is necessary in such places to anticipate serious corrosion by replacing the damaged equipment as necessary, even when every means of protection was originally adopted. Sprinklers are coated with ozokerite by the makers, which will protect them for a greater or less time, but this will finally get displaced. This is the "corroproof" head. Another method used is to place a glass cup over the head sealing it at the base with a soft grease. It is astonishing how soon such a head will open, in the test oven, only requiring a half more time than a bare sprinkler. In practice, however, not many are so installed. The piping in dye houses is apt to be actively corroded and in such places as the nitrating room of a gun cotton factory or the blow tank room of a sulphite mill it is almost impraticable to maintain an operative sprinkler system on account of corrosion. Painting the pipe with a good inert paint or varnish mixture which contains nothing that can attack the pipe will go far towards its preservation, repainting as needed, and such special paints

are sold. There are locations where it has been found necessary to use brass pipe, but this is so expensive as to be the infrequent exception.

Drawing water for service from some part of the sprinkler system has caused a great deal of trouble. First, it brings in sediment or substances in solution in the water which in time reduce the area or even stop up the waterway entirely and, second, it is the principal reason why water works authorities sometimes refuse to permit a connection to a fire system without a meter, most types of which offer considerable obstruction to flow and any of which are likely to be installed without suitable provision for the continuance of the water service when the meter has to be removed for repairs.

In all plants, but particularly in those where internal changes are common, there is danger that the men engaged in such work will without notice to the executives disconnect a sprinkler pipe which inconveniences them or close a valve or both. This will put out of service from one head up to an entire system. Too often they forget to open the valve even if they do not forget to reconnect the pipe. Superintendents and managers should watch out for these things and make it a practice to see that all sprinklers are put in commission again without delay. If there is a master mechanic or piper he should be made responsible for these things.

When sprinklers open for any cause, it is necessary to replace them with new ones as soon as proper, otherwise even one head may cause careless delay in putting a whole system in commission. It would take three or four days at least to procure sprinklers at many a small town and even though the outlets could in such case be plugged and the water turned on, the tendency is to wait for the sprinklers. Moreover, to plug the outlets means they are likely to be left so. I once found an entire blind attic system left with plugged outlets. There are emergency stops manufactured which can be put into a sprinkler which has opened so that the water can be turned into the system without delay and at least one is made with a solder joint so as to approximate the link which it temporarily replaces. To obviate these troubles it is required to keep on hand at least a half dozen new sprinklers, so that replacement may be made immediately and it is always necessary to be careful not to select a sprinkler of the wrong fusing point for that place. Note here a reason why the fusing temperature of a sprinkler is cast on the frame even though it is likewise marked on the link. Without the figures on the frame it could not be told with certainty what was the fusing point of the sprinkler which opened, for the links flew out and were swept out with the water and rubbish and even if they were found, they could not be identified as belonging to any particular sprinkler, assuming several opened.

The danger of freezing, especially in the main supplies, must be safeguarded and it is not safe to assume that this danger is absent if the installation was originally safe. Although freezing frequently occurs inside buildings because of carelessness with windows or heating service on suddenly bitter cold nights or week ends, it is usually only a small number of sprinklers that is affected and leakage calls prompt attention, but when freezing occurs in a main underground or elsewhere out of sight, the temperature may not warm up again, as it would inside a building, for weeks and the main may remain plugged with ice and the system useless. There is one well known instance of a total loss of $250,000 from just such conditions. A carelessly filled trench may settle, the grade may be subsequently cut down too much on a bank, for instance, porous fill may be used, the pipe may be run with too little protection over the arch of a tail race or culvert where the depth of earth is shallow and cold comes both from above and below. Remember that a fire main has no circulation and therefore the water in it will freeze where it would not in a service pipe.

There is one disadvantage of a sprinkler equipment, which is the possibility of water damage from accidental leakage or discharge from it. Where there are so many pipes and sprinklers distributed, it is not surprising that the sprinklers occasionally break from defects of manufacture, the overheating of the room, blows, corrosion, freezing, and that the pipes should break from settling, overloading the building, and other causes. The tanks fall, sometimes doing great damage. Freezing is the most common cause of trouble and it occurs all over this country except where it never gets cold enough to freeze, even in parts of the southern states. In bitter cold weather pipes of all sizes are burst by frost and heavy losses occur.

When freezing occurs it very often shows by bursting a fitting, blowing out a piece of it. All sizes burst, even the principal mains.

Considerable comment on leakage has been made by people without experience, claiming that it occurs comparatively seldom and is trivial. This is not at all true of the general sprinkler leakage business.

About all the sprinkler contractors carry insurance against sprinkler leakage for which they may be liable as a result of work they have done on the system and many owners and tenants of sprinkled risks insure against leakage on their own account.

The policy contracts are standardized and the business is rated according to the physical conditions that affect leakage which are not as a rule the same that affect fire insurance.

Usually the assured carries 10% insurance to value and in this section there is as yet no provision for greater than 30% co-insurance.

The conditions that predispose to sprinkler leakage can be recognized by an expert and as a rule the assured is willing to remedy the trouble. The principle bureaus in this section of the country now consider these things in connection with their regular surveys and report recommendations.

It is quite common to break open a sprinkler by an accidental blow. To prevent this guards are made which can be slipped over the sprinkler for protection. These devices are now being submitted to the Laboratories for approval and some have been approved but there are some that are badly designed so that in certain positions the links of the sprinkler catch on the frame of the guard and the sprinkler will not open. The safest remedy is to buy only approved guards.

It was trouble from sprinkler leakage in a dry system that caused us to investigate the formation of ice in dry systems and resulted in the development of very interesting information, which, however, is not yet exhaustive.

If the temperature drops below freezing in a wet system everybody understands that there is water in the pipes which will freeze, but it is not commonly considered that there may be water in a dry pipe system which will freeze and either burst or plug up the pipes, but this is often the case.

Theoretically the dry pipe system contains only compressed air and is therefore safe to use in cold locations. Actually water gathers in it and freezes and although the writer has no desire to pose as an alarmist, it is a fact that the actual condition of a dry system in cold places is seldom known and is difficult to ascertain and there is more interruption to service in parts of the system than is generally believed.

Water gets into a dry system in three ways. It is purposely introduced on top of the dry valve to seal the air valve, it is carried in very small quantities as moisture in suspension in the air put in by the air pump used to keep up the desired pressure and it gets in if the valve trips.

It does not require much water in a system to block up a pipe because ice formed by the gradual deposit from the freezing of moisture carried in the air is not solid but cellular and it is estimated that it occupies about twelve times as much volume as the water which it would form if melted, but it is an effective plug, nevertheless. This is to say that such ice from one gill of water — about half a glassful — would fill a 3-inch pipe for 12¼ inches of its length. Any water in a system, even the priming water, may be, and probably in most cases, is picked up as moisture in the comparatively warm dry valve and rises till it comes to a place cold enough to cause the air to be unable to carry some of it and that which is deposited freezes. This action is probably favored by the practice of connecting at the dry valve the pipe from the air pump and this air may not have cooled very much after compression which heats it. In

every dry system there are differences of temperature. at least between the dry valve which must be kept above freezing and is usually 75° or more, and the rest of the building which may be very cold. In a cold storage building there will be several different temperatures, down to 0°F. sometimes. Where the warm moisture laden air strikes the colder place is where the ice forms in this way, especially where the sprinkler pipe is in contact with refrigerating pipes, and it starts as a ring on the inner surface of the sprinkler pipe and in the course of time becomes a complete plug. How long it requires we do not know, but must find out by taking down piping at different places known to have been free of ice at a certain time, and observing the condition again after definite periods. Possibly somebody will insert a section of glass pipe through which the action can be observed without disconnecting.

We know this, that such stopping of 3″ and 4″ pipes will take place in the winter in an ordinary dry system. To prove this and also that the moisture laden air does act as described, we have record of the following occurrence: At a large edge tool plant the sprinkler system was in charge of a careful and intelligent man who was in the habit of making daily readings of the outdoor temperature and of the pressure gauges on the systems. On one occasion he noted a heavy drop in temperature but accompanied on one system by a considerable increase in gauge pressure, which he knew was inconsistent. He took apart the riser just outside the dry valve closet and found it filled with ice which had undoubtedly been gradually forming, the last aperture having been closed by the ice formed the night before. The riser at this point was vertical and ice could have formed there under the conditions found only by the freezing of moisture from the air.

If the piping of a dry system is not arranged to drain back to the drip pipes, either because it is not installed properly or because the piping gets out of line afterward, water admitted will in part remain in the low places, to freeze. Lightly built structures or those which have varying and heavy loads are very apt to have this trouble and a dry system in such is not as good a protection as in substantial buildings which cannot change level from loads due to the contents, and in which also there is less trouble from leakage of air.

In systems where it is hard to keep up the air pressure, the dry valves are apt to trip because the air pressure gets too low and water enters. If there are any troubles like those just discussed some of the water remains and the more often a valve trips the more chance of this there is. Even in a normal system all the water will not drain out at once, probably because of adhesion to the pipe and water can be obtained at successive drainings for several days.

The water introduced as moisture in the air from the air pump is very little, though in the course of time appreciable. It is the least of the causes contributing to the formation of ice in a dry system. The net increase in the water introduced into a system of 500 heads in pumping up the air pressure from 35 pounds to 45 pounds, the temperature outside 75° F., hygrometer reading 85° and the temperature inside the system 32° is .0066 gallons and ordinarily the conditions would be such that less water would be introduced. In other words the air would have to be pumped up 100 to 150 times to put in as much water as is to be found normally on top of the dry valve, which would ordinarily require a period of about that number of weeks in a system in average condition of tightness.

So far as yet discovered no sure cure for this ice formation has been discovered. It is always advisable to take air for the compressor from a dry, cold place instead of from the engine room, as is common, and it would be a help to pass it through a drip chamber with baffle plates, located in a cold room. The moisture can be removed by passing air through calcium chloride but it is not often done and I feel that nothing like the theoretical possibilities will be continuously attained in ordinary practice. It might help to connect the air pipe into the system at a distance from the dry valve.

When Parmelee invented his system one of the things he sought to do was to make it serve also for heating and he made some experiments with sprinklers placed on U shaped branch pipes so the heat from the main would not open them. Apparently little practical use was made of this method.

About six years ago a large southern corporation put the same idea into use, not so much for the heating effect as to obviate the necessity for using dry systems or shutting off cold sections, and they warmed the water by putting it through an injector which also served as a circulating pump, regulation of circulation being governed by small holes in diaphragms in connections made to the ends of sprinkler lines. So far as the writer knows the heads were screwed directly into the pipes in the usual way and some were opened by excess heat. Apparently no use of this arrangement was made by others.

In 1912, Pierce Brothers, Ltd., New Bedford, Mass., put into their weave shed a combined heating and sprinkler system in which hot water was made to circulate through the pipes, the sprinklers being placed on horizontal branch pipes about 10 inches long parallel above the main and connected to it by a short nipple. With the same plan a few other plants have been equipped.

Somewhat later the Combined Heat and Sprinkler Company of Boston, took up the business and a limited number of plants were equipped under licensing arrangements made by them with

the sprinkler companies, as the former company did not install the systems, twelve or more having been equipped. Litigation over the patent rights developed.

The object of the plan is to make the sprinkler system also do the heating, but in buildings of the usual construction and relative wall and window areas it is necessary to install auxiliary heating coils, which would not always be necessary. The argument in favor of the system is a less cost than that of a hot water heating system and a sprinkler system installed separately, the hot water heating being more economical of fuel than steam and less subject to variation. The cost comparison with steam heating is not so favorable to the combined system though it is said that even against steam it can make good showing. Probably the cost argument is better for the combined system with large, wide buildings than with smaller ones.

The sprinkler system is installed and operated the same as an ordinary system so far as fire protection is concerned. With the combined system dry systems are alike impracticable and unnecessary. There are some special details required, however, each sprinkler being attached to a curved pipe from a horizontal outlet of the tee, this pipe being curved down below the supply pipe and then brought up higher than the same to the head. This downward curve or trap in the branch effectively stops circulation therein and prevents the heating of the sprinkler which in most cases undoubtedly has air in the pipe directly beneath, though this is not essential. Following the curve of the branch pipe this is about 18 inches long with which a temperature of 238° F. was maintained in the supply main without raising the temperature of the sprinkler above 100° F. which was only 14° higher than the temperature of the room. The water in the curve of the branch pipe cannot be drained out through the system but it has been frozen there without damage to the pipe as there is no cast iron fitting where the ice can split it.

To provide for heating, a hot water heater is put into the lowest part of the building, often a steam heated drum with tubes through which the water passes, the water is forced through it by a small centrifugal pump if any aid to circulation is necessary, though in ordinary cases no pump is needed. The water from the heater is discharged into a hot water riser that is connected by branch piping to the ends of all the sprinkler lines usually in groups of three or four with a valve operated by a key for each group so that the circulation can be regulated as need be. The main riser serves as the hot water return pipe to the heater. There is a separate riser and return for the auxiliary system.

No expansion tank is now used but a relief valve is provided near the heater and to supply water as needed on account of the very gradual contraction on cooling, without causing any

movement of the alarm valve, a small by pass is put in around the alarm check containing a union with a diaphragm having a $\frac{3}{16}$-inch hole. The by pass contains also a hand valve and if necessary a small meter. The main supply valve to the sprinkler system controls the entire water supply as in an ordinary system.

The circulating pipe connecting the ends of the sprinkler lines serves to cause the sprinklers to be fed from both directions and thus cuts down friction loss, subject to the qualification that the circulating valves in these pipes may be partly closed.

The questions that this combined system raises are several. The natural one whether sprinklers may not occasionally be opened by the heat of the system appears to be settled in the negative for ordinary conditions where the proper forms of offset branches to the sprinklers are used as apparently is now done. The earliest forms did permit a few such accidents. Nevertheless the matter is not conclusively settled yet because the field experience has not been sufficient. Whether a sprinkler located in a closed unventilated space, like the top of a small closet, yet on a pipe where the needs outside demand circulation of water at 220° F., may not be opened by the heating of the air in that confined space even if not directly from the heat in the offset pipe, is to my mind an open question. A few cases of bursting from freezing have been reported, due to improper regulation of circulation and faulty installation. Such accidents might result in sprinkler leakage loss. A test with water in the pipes at 210° gave the temperature of the spray close to the head as 100° F., and five feet away it felt only lukewarm to a bald headed man who volunteered to try it.

The use of the combined system to take the place of the dry pipe system with its doubt and complication would be a good thing, but least likely to take place because from the conditions those places do not require heating.

The system offers an easy way to avoid the necessity for shutting off sprinklers in some sections of an elsewhere warm building of which there are many such, too small to be considered worthy of a dry valve, yet constituting a greater or less menace to efficient protection, as well as the means of obviating a dry valve in larger sections where it would unquestionably be supplied. The temperature in such places can be regulated, by controlling the circulation, to no more than the conditions need, therefore at the least possible maintenance expense.

There is said to be no trouble from the deposit of sediment and it is reasonable to expect that there would be no more than has been surmounted in hot water heating systems, though there are likely to be places where special consideration would have to be given.

It is a question whether the convenience of drawing hot water from the system for some minor purpose might not be a temptation to make a connection which would not be done

with an ordinary cold water system, resulting in the unseating of the alarm valve with the tendency to cause false alarms from leakage due to grit consequently deposited on the seat.

Taking everything into consideration it appears that the combined system has a field which has not yet been developed, but which is up to this time developing slowly.

The remarkable efficiency of automatic sprinklers as ordinarily installed and particularly the control of fires with few sprinklers, has caused suggestions from time to time that a sprinkler system piped as usual should be fed with some limited inexpensive single water supply but to receive reduction in rate. One man suggested only a steamer connection supply, another only a little electrical pump.

This idea has now been introduced with the supply from a chemical extinguisher tank, which operates automatically. It is called the "Sypho Chemical Automatic Sprinkler System."

The only supply is a chemical extinguisher tank, either 100 or 200 gallon capacity, and on account of the limited capacity it is admittedly expected only to take care of those fires which can be handled by not more than three sprinklers operating not over five minutes. In order to limit the installation to those risks which are fitted for it as well as to insure proper supervision, refilling and maintenance it is to be leased, not sold. It is understood that the prominent sprinkler companies will have the privilege of putting in the system, which is a proprietary one.

Its owners argue that it will have a wide field especially in mercantile and light manufacturing risks of moderate value and that its usefulness will be greater than the statistics of "one sprinkler" fires indicate. They say that the published percentage of fires extinguished by one sprinkler, 30%, is much too low for the results *they* will attain with one head, because it was obtained from all sorts of risks, good, bad, and indifferent, whereas their risks will be selected, and because many one sprinkler fires are not reported on account of their insignificance. There is logic in both contentions. As yet very few installations have been made but it is expected their installation will soon become general.

On account of the assumption that this is only a "one or two sprinkler fire" system, the piping is much smaller than in a regular system, being nowhere more than 2 inch and that the riser. The pipes will be run and heads distributed as in the ordinary way and as the syphon action and the small capacity of the supply require the system to be always completely filled with liquid to avoid trouble from freezing they will be filled with calcium chloride solution, which the advocates say will not cause trouble from corrosion or otherwise. The ends of all the sprinkler lines will be connected by small piping as the system must be filled completely without air pockets, since the auto-

matic action of the extinguisher tank depends on the siphoning action of the partial vacuum produced by the fall of level of the liquid in the system when a sprinkler opens and the expansion of air might prevent it.

The riser is carried up about eight feet above the highest sprinkler to a small cylinder with a gauge glass and from the top of this cylinder a small pipe leads down to the siphon from the acid container in the extinguisher so that the flow of acid may be started by that means. Ingeniously, the acid feed is shut off by increase of pressure which is thus maintained quite constant and a neutral solution is secured which guards against damage from excess of acid. The only gate valve in the system is devised so it cannot be closed except when the pressure is on and it is expected at such a time that nobody will be likely to touch it except someone familiar with the system.

By the action of the operating pressure on diaphragms an electric bell alarm and a mechanical water motor alarm may be rung as long as the extinguisher is operating and the pressure is so high, about 150 pounds, that there is little chance of the alarm contacts failing to operate. There is no chance of false alarm. None of the contents of the supply tank is used to operate the alarm.

By actual test with a 100 gallon tank one sprinkler discharges effectively about 6 minutes and two sprinklers about 4½ minutes. Probably the pressure in the piping is a little lower with two operating. In a small frame shanty it puts out fires in a considerable quantity of very combustible material. Of course the room is small, and there are no obstructions. Undoubtedly the system has merit, but the degree remains to be established.

On account of the necessity of filling the system with the proper solution to the top quite exactly and charging the extinguisher tank properly, it will not be sold, but leased and supervised. It will be essential to have the supervision good enough so that recharging after use shall not be delayed and any temptation to install it where the conditions are unfavorable must be rigidly repressed or it will be discredited by failures. It cannot be expected to fill the place of the full fledged sprinkler system.

Every underwriter is bound to take chances of heavy or total loss because a valve is closed or the sprinkler system otherwise out of order when a fire occurs. There have been quite a good many such fires, not to mention many lapses of maintenance which did not happen to bring serious results. To prevent such occurrences so far as possible, the American District Telegraph Company has perfected a supervisory system commonly spoken of as the A. D. T. Supervisory system, which they operate under the same organization as their other service, such as watchman, burglar alarm, etc.

By means of mechanical attachments arranged in an electrical circuit and attached to the devices of a sprinkler system, the supervisory system sends an alarm to the central office and a man is at once sent to investigate and set conditions right, either himself or by calling the proper employee of the assured. Where there is a good central office organization the alarms are promptly investigated but it is obvious that these results are likely to be better in a place where such is the case and where the risks served are reasonably close to the office, not scattered about in the suburbs.

The supervisory system is usually arranged to give the following indications:

Water flow.

Closing and opening gate valve.

High and low pressure alarm, usually used on systems and pressure tanks.

Water level alarm for gravity and pressure tanks.

Temperature limits for tank water.

In a sprinkler system which is equipped as completely as possible with the supervisory system, all the tanks, gate valves, and risers are fitted with the different devices and sometimes the valves of steam pumps are likewise equipped. Ordinarily it is impossible to apply these safeguarding devices to any valves outside of the buildings, such, for instance, as city valves in the sprinkler supply, which are, however, much less apt to be interfered with than those in the building. So far as the system in the building is concerned, it prevents in the greatest degree yet possible the temporary discontinuance of sprinkler service, especially limiting the time in which it is out of service when necessary repairs are being made. The wiring is installed in conduit right up to the alarm devices so that none may be exposed to malicious or careless interference and if a break in the circuit occurs a trouble alarm is received. The supervisory system trains the assured to take better care of his sprinkler system and its records give underwriters information in regard to the relative care exercised at different risks and very clearly indicate where persistent carelessness exists.

The system has only been put in in the larger cities since obviously the complete value depends upon the maintenance of a somewhat elaborate office organization.

The report of the company for the quarter ending March 31, 1916, shows that they had altogether 2,104 buildings completely equipped with the supervisory system in 73 cities, the greatest number being in Chicago, Cincinnati, New York, Minneapolis, and Toledo, which contain 939 of these. To illustrate one of the most common troubles with sprinkler maintenance, note that for the quarter the number of alarms for gate valves closed averaged 1.9 per building. Out of 5,376 signals indicating flow of water in the sprinkler system, which

did not include tests made purposely, only 84 were for fire and 473 for leaks, while 4,819 were due to working on the system and other such causes, which shows pretty plainly how much chance for interruption to sprinkler service there is and what a good check on it supervisory service exercises.

With all the precautions that can be adopted to make efficient the sprinkler system in the risk itself, the best system may be burned out of existence by a severe exposure unless the openings on the risk are efficiently protected. One of the best examples of this fact is the Naumkeag Cotton Mills, Salem, Massachusetts, a risk of excellent construction and equipment, which was practically destroyed in the conflagration of 1914, as well as a number of other sprinkled risks with less ability to resist. Such long continued exposure opens so many heads that even the most robust water supplies are likely to be overtaxed and then the risk burns.

The fact must be admitted but as it happens only 62 cases have been reported of the failure of sprinkler protection by reason of exposure or conflagration covering a period of 18 years, in which the reported number of unsatisfactory sprinkler fires of every sort was 813, or 4.65% of the grand total of sprinkler fires, 17,533.

Based on this grand total, statistics concerning the efficiency of sprinkler protection are derived. These statistics must err on the side of not showing sprinkler protection as efficient as it really is, because since it is impossible to obtain a report of every sprinkler fire, those which are put out by a few sprinklers with small loss would be the kind least apt to be reported since they are more likely to escape the notice of the insurance organizations than those of heavier loss or spectacular failure. Therefore, the insurance sprinkler statistics are conservative.

They show that only one sprinkler operated in 31.1% of 17,093 cases, only three in 57.8% and that 85.2% showed the operation of not more than 12.

Of 15,252 cases, 80% were under the wet system and 20% dry system, which is a good indication of their relative use.

Subtracting the unsatisfactory sprinkler fires, there were 16,720 cases of satisfactory sprinkler control, in 64.51% of which the sprinklers extinguished the fire practically unaided.

Some kinds of risks handicap sprinklers by conditions of their occupancy, principally for one or more of these reasons: very combustible contents, explosion hazard, obstructions, corrosion or loading, operating conditions otherwise unfavorable to maintenance of sprinkler protection. The percentage of unsatisfactory sprinkler fires was 3.8%. Taking those classes that show too few fires reported to give a dependable experience and fixing 7% or more of unsatisfactory sprinkler fires as the basis of selection gives the following classes of risks as showing the most difficult of sprinkler control:

Car Houses,
Celluloid Factories
Cereal Mills
Chemical and White Lead
Cooperage Plants
Cotton Warehouses
Cotton Seed Oil Mills
Elevators, Grain
Fertilizer Plants
Flour and Grist Mills
Furniture Factories
Glass Works
Hat Factories, Fur
Match Factories
Morocco Leather Factories
Oil Cloth and Linoleum Works
Paper Mills
Picture Frame Factories
Chemical Pulp Mills
Saw and Planing Mills
Shoddy Mills
StampingandSheetMetalWorks
Tanneries
Wooden Box Factories

The record of automatic sprinklers has been so good that even in the hearts of cities where a sprinkled risk may be subject to destruction from conflagration exposure, every newly equipped risk is considered as diminishing the chance of conflagration since it is almost never the case that a fire in one sprinkled risk extends to another one and a careful examination of the records of loss of life in buildings equipped with automatic sprinklers shows that there have been very few cases indeed. This most important feature of protection to life has led to the passage of municipal ordinances and in some cases state laws requiring that risks which employed large numbers of employees under conditions unusually unfavorable to their safety in case of fire should be equipped with sprinklers.

The economic reason for equipping risks with sprinklers because of the saving in insurance premium has been the particular incentive to the property owner in the majority of cases because this reason is always present.

The total number of sprinkled risks (not buildings) in this country is probably about 25,000, with an approximate increase in number of about 8% a year, with every indication for the immediate future that there will be no material falling off in the number of risks equipped from year to year.

The Analytic System for the Measurement of Relative Fire Hazard

BY

EDWARD R. HARDY

Some Notes on the Analytic System for the Measurement of Relative Fire Hazard. These Notes are based on the Four Lectures delivered before the Insurance Institute of Hartford, January and February, 1916.

The Analytic System for the Measurement of Relative Fire Hazard — more commonly known as the Dean Schedule — is set forth in its full form in the edition of 1914, by Mr. J. V. Parker, Manager, 76 West Monroe Street, Chicago, Ill. An explanation of the system based on lectures and class work is published by Jay S. Glidden, Chicago, Ill. In addition to these standard publications the student should acquaint himself with the writings of Mr. Dean, among others the following:

"Rationale of Fire Rates, 2nd Edition, Chicago, J. M. Murphy, Pub."

"Fire Rating as a Science, same place and publisher."

"Fire Hazard, is it Measureable? A. F. Dean, Chicago, Ill."

Mr. Dean has set forth in a letter published in the Cyclopedia of Fire Prevention and Insurance this statement in regard to the historical development of this system:

"It began with a paper read before the Missouri, Kansas, and Nebraska Fire Underwriters Association in 1880, on the subject of "Irregular Frame Exposures." This paper embodies some formulas on the subject which I personally used for many years. On July 17th, 1889, I formulated a schedule, at the request of the companies, along the same line of reasoning, but it was not adopted because of its being regarded as too complicated. On December the 11th, 1902, I issued a pamphlet entitled "Exposure formulas and basis tariff for frame, iron-clad, and brick veneered buildings and contents." This was at once put to use for practical rating purposes in Illinois and several other states. On March the 11th, 1903, I completed a basis tariff for brick buildings, and contents, which was also put to immediate use by the companies. On June 27th, 1903, I issued a second edition combining the two tariffs above named, under the title of "Mercantile Tariff Exposure Formulas for the Measurement of Fire Hazard," which also went into immediate use as a rating tariff for the smaller towns, but the use of it in larger towns required various expansion, and on October 17th, 1904, I issued a new edition under the name of "Analytic System for the Measurement of Relative Fire Hazard." Immediately after the Baltimore fire I was asked to expand the system so as to cover the large cities in lieu of the tariff that had been in previous use. This was done, but the tariff did not go into use until immediately after the San Francisco conflagration. On June 15th, 1906, the edition for large cities was issued and has been in use ever since, being expanded from time to time as new problems arose."

The method of determining the rate in fire insurance has shown a progressive tendency from the beginning. It originated naturally with what we commonly know as the "flat rate system," but from that it soon departed and began to split the flat rate into different parts for the purpose of more correctly analyzing the hazard involved. The Dean Schedule recognizes the fundamental factors which affect the rate of insurance; building, construction, occupancy, protection (whether it be public or private) and the exposure charge. These factors were early recognized in rating as soon as the flat rate system commenced to be departed from, but while recognized, later schedules have carried their analysis to a higher point, and one of the developments is a truer analysis of these different factors.

The Dean Schedule while recognizing the points noted, considers two other principles of equal importance. They are: First, the element of place. This deals with the different amounts of losses in different localities on the same class of risk. It is stated that as you begin at the eastern seaboard and travel westward, at least to the Rocky Mountains, the average of the loss cost constantly increases. In other words, the burning ratio is higher. A test was made of twenty-two states selected somewhat at random, eight east of the Ohio showed an average loss cost of .55 per $100 for 13 years, and fourteen west of the Ohio showed .79 as the loss cost, which is 44 per cent higher than the states east; Wisconsin runs in the neighborhood of .72, and Texas usually not less than .89, and sometimes above that.

Second, the element of time. On this point Mr. Dean had best be allowed to speak himself:

"You doubtless realize that as a system schedule rating consists of the establishing of revelations in hazard; that it deals with a complex problem of relativity. Year after year there is an unending succession of changes in the loss and expense ratio, which together constitute the cost ratio of fire insurance; and there is an imperative necessity that rates shall be changed with some regard to the fluctuating cost of the thing sold. The present tariff system makes no provision whatever for making these changes in rates. It is simply a system of static relations. To make rate changes it is necessary to construct new basis schedules, which are merely congeries of untried suppositive relations, and then apply these schedules in making hundreds, perhaps thousands, of local tariffs. To re-rate the entire country in this way is a task of greater magnitude and expense than that of taking a national census.

"Before these new tariffs can be applied there is almost sure to be a rise or a fall in the wave of annual loss, which makes the new rates either too low or too high. There is no assurance that, when they become effective, the new rates will fit existing conditions any better than the old rates. If too high, there is a revolt on the part of the public, and an immediate growth of mushroom competition which makes it necessary to begin at once the work of daubing the new tariff with competitive rates. These competitive rates, from their nature, are out of alignment with other rates, and as they multiply, soon destroy all relativity as well as all fairness in the tariffs. Again, high rates generate preferred classes, which are greedily sought by companies willing to pay high commissions, and this leads inevitably to a permanent increase in the expense

ratio, which must ultimately be made good by the public. If rates are temporarily too low on some classes, other classes must make good the deficit. If too low on all classes, there is an exodus of insurance capital, until, in a panic, rates are sent skyward by a percentage advance which, unlike the rain, falls harder on the righteous man than on the unrighteous, for the man who is already paying the highest rate, relatively, must submit to the largest increase under the percentage advance. The result of this is that the house of fire insurance is a house undergoing constant alterations and repairs. The hammer and saw of the builder and the pick-axe and shovel of the wrecker never cease their din in the process of schedule rating and unrating. Anything approaching order, system, or any of their synonyms in this turmoil of creation and destruction is out of the question; even in the last resort of a percentage change in the absence of any generally accepted definition of classes, it is impossible to describe what groups are to be changed without a long sequence of explanatory circulars, and circulars explanatory of these explanatory circulars."

The rate is defined under the system as a "bundle of relations." It is all a part of a whole, and yet all so bound together that it constitutes but one body, and you cannot disrupt or over-emphasize a part without disturbing the whole. To correctly measure fire hazard it is necessary to set up standards that may be, though in many cases they seem to be, rather than are, empirical standards. This seeming is due to the fact that our knowledge is not yet exact enough to correctly estimate the affect of fire, smoke and water under all circumstances when once a fire has been started. In many cases we are able to develop standards which enable us to bring a thing down to a certainty or practical certainty, knowing that if the hazard is grouped in the way the standard says it shall be, the strong chances are that no fire will result.

The schedule itself must be empirical because it is merely the expression of the standard, but this is true of all standards that exist; no reason why a certain length should be called a foot or a certain number of ounces a pound, or a certain amount of time an hour, but the commonly accepted standards for these elements have been adopted, and empirical though they be, they perform the work for which they are intended. The Analytic System, it has been stated, is founded on the belief that the analysis of fire hazard involves a measurement of the relations which embrace our knowledge of fire hazard, by a standard which must necessarily be empirical and which must be applied without change to all degrees of hazard now existing or possible to exist.

The shedule is based, so far as credits and charges other than the base rate are concerned, almost entirely on the percentage system. This is departed from in two respects which will be explained, one dealing with susceptibility to damage, and the other with after charges. Now this percentage system is the thing which welds the parts of the schedule into a consistent whole, and makes it sustain to the community a different relation according as the losses vary from time to time. If, for instance, in a certain town the basis for frame buildings

was .80 and there was a charge for a non-standard chimney of 10%, the charge would be .08. Now let us suppose that the experience of this town has improved — or its physical conditions, rather — and we are able to make a base rate of .60. The charge for our chimney is still 10% or .06. In other words, it maintains to the basis rate the same relation which it did before, namely 10%. Under most other systems the charge for the chimney would be a flat charge, let us say, of .10. This is 12½% of the basis rate of .80, and when the basis rate drops to .60 it becomes 16⅔ of that basis charge. This illustrates what, in the schedule, is called the "theory of relativity." In other words, the parts of the rate are consistently held one to another, never mind how much the general basic conditions may vary.

Passing from these general principles we come to the manner in which the details are taken care of.

Height: As a standard a one-story building is taken and charges added as the building increases in height. This height charge is based on a progressive increase until it reaches the sixth story when, as it is considered beyond the reach of the fire department, the same charge is made for the sixth story and each succeeding story. If there is no basement a reduction is made from the basis rate, while the sub-basement is charged an amount equal to the deduction for a basement.

Area: The standard for area is 1,000 square feet. The student should notice that the standard pre-supposes a very small structure, one story in height, 1,000 square feet area. The charges are added for the increase in area from that point. The area charges are subject to increase for shingle, non-approved composition, or a mansard roof of frame construction. They are likewise subject to decreases if the occupancy be classed as non-hazardous, and also may be reduced by means of division walls which divide the property and pierce the roof. The area charge operates in conjunction with the height. Thus, a building of 4,000 square feet area covering one floor would have 4% added, two floors 8%, three 11%, and four floors 14%.

Walls: The tariffs or basis used pre-suppose either the brick or the frame wall condition. Where the brick is used charges are added for the sub-standard condition; this is normally 1% for each 1 inch of deficiency that the wall averages. The schedule furnishes standards for party walls, independent or exterior walls, walls ledged or not, those braced with pilasters, and those of pier construction. The occupancy affects these charges as it does in the case of area. Charges are provided for the lack of a proper parapet if the building is near enough to another property to be damaged by an exposing fire.

Roof: The brick building calls for a roof of metal, tile, slate, or approved composition as standard, while 20% is the increase made for a wooden roof as shingle or an unapproved composition is accepted as standard, and an allowance made if the roof be of metal, tile, slate or approved composition.

Ceilings: In brick buildings a charge is made for wooden ceilings, each story, and a larger charge for strawboard, paper or canvas ceilings, each story. Should the walls be sheathed as well as the ceilings these charges will reduce one-half.

Skylights: A charge is made in brick buildings for openings which pierce the roof and are not covered by a standard skylight, 3% for the openings 40 square feet or less, subject to an increase of 1% if the skylight exceeds 40 square feet, and 2% for each additional skylight.

Floor Openings: All the openings through a floorway are referred to as its "retinue." The floor openings are divided into grades, that for "A" running as follows:

A. Matched wooden flooring laid on joists of ordinary dimensions with lath and plaster, wood or metal ceiling beneath. (This is the lowest type of grade there is.)

B. This grade is the same as "A" with the exception that there are two layers of matched flooring.

C. (1) The floors must be not less than 3″ thick;
(2) The supports for the floor beams, girders, posts, at least 6 x 6 inches. If iron or steel must be protected;
(3) The finish should be without concealed spaces;
(4) Any partitions must be non-combustible.

To illustrate the manner of charging or crediting: If the floor opening or retinue, as it is called, be below "A" an addition of 5% is made for each floorway. If it be "A" there is neither a credit nor a charge made. If it be equal to "B" a 1% credit is made for each floor.

As this treatment of floorways is so important, a bit of an illustration may not be out of place: The floorways are matched, take the grade of "A"; there is an elevator running from the basement to the second floor, where it pierces the first floor it is protected by an automatic elevator trap which grades as "A". When it passes through the second floorway it is unprotected and so grades "below A." There is also a stairway basement to third floor, all openings unprotected, and so ranks "below A". Now the poorest floor opening determines the charge in the floorway. In this case this is the stairway. So for the first floor the charge will be 5%. The second floor will be 5%, plus 1 or 6%, and the third floor will be 5%, or a total of 16%.

It should be carefully noted by the student that this manner of charging for floor openings is a very consistent piece of work. It binds the whole thing together. It is probably fundamentally true that the enclosure to a shaft need not be so much better

than a floor itself, and if you have a single 1-inch matched flooring, the floor opening protected by the equivalent of that with a substantial wood door, is undoubtedly all right.

Partitions: Must be what would be commonly accepted as fireproof, brick, tile, plaster on expanded metal. A charge would be made for wooden partitions.

Chimneys: These, it is recommended, should be of brick; must always be built from the ground, though a chimney built on a ledge in the wall may be accepted.

Outside Attachments: A brick building is assumed to have no wood trimmings such as cornices, awnings, roof houses, etc. A small charge is made if any exist.

Warerooms: In many cases a very good brick warehouse has added thereto what is commonly known as a one-story extension. Usually this is of an inferior type of construction, as frame. This bad feature is taken care of by a percentage charge which is determined by the relation between the floor space of the wareroom and the floor space of the entire property.

Superior Construction: Even an ordinary building may be superior to the general run of such properties, and recognition is made of that fact.

After-charges: These take care of other bad features such as broken plaster, holes in the floor, cracked walls, etc. To secure the correction of such defects the generally accepted system of a flat charge is made, and this is the final charge in the rate.

An example of rating:

Ordinary Building.

Basis, 5 story and basement building,	$0.77
Area, 5,000 square feet, six floors with basement,	22%
Two walls, side, deficient 4 inches each at 4%, total,	8%
Two parapets, deficient, each 2%, total,	4%
Five floorways grading as "B" with two openings each floorway grading as "below a"; this is 5%, plus 1%, equalling 6%, multiplied by the number of floors (five), total,	30%
Inasmuch as we have not yet considered occupancy, we will consider that the occupancy adds,	109%
The total additions, therefore, to the basis rate are: area 22%; side walls deficient 8%; parapets deficient 4%; floorways 30%; occupancy 109%, or a TOTAL of,	173%

that is, we add 173% to the basis rate of .77.

Occupancy.

Mr. Dean has said that in the matter of occupancy there is no evidence that any of the rating schedules have treated it except in a very elementary manner. The risk of occupancy, meaning thereby not merely the risk to the building but to the

occupancy or stock itself, is split into three parts. First, as something which may cause a fire; second, as a fuel or medium for fire; and third, as the effect of fire, smoke and water on the stock. The first can be defined as the cause; the second as the medium, and the third as the damageability.

The first, or causation, can perhaps be better considered if we consider the second first. The schedule divides combustibility or fuel into these grades: Low, Middling, High, Quasi-Incendiary, and Incendiary. These are five grades but there are a couple of intermediate grades which are used, as one coming between the third and fourth, and one between the fourth and fifth. Within these groups examples may be given. Low: a stock of hardware; Middling: retail groceries; High: straw goods, saltpeter, etc.; Incendiary: oils such as petroleum, and of course the lighter varieties, ethers, paints, turpentine, etc. The grade which is placed between three and four refers to large open stocks and not to the character of the stocks, and that placed between four and five deals with risks having a minor industrial hazard.

Causes.

Causes are divided into "active" and "inert." The inert are represented by banks, offices, etc. The active are divided into dwelling occupancies, places of assembly, and third, the industrial group. The dwelling group or habitational, as it is called, includes dwellings, apartment houses, boarding houses, clubs, etc. Places of assembly include everything where people gather from clubrooms to schoolhouses, while the third (industrial group) embraces every variety of manufacture where motive power is used, and usually in connection therewith some form of heat. There is a special table dealing with the labor charge, the minimum charge being five hands or under, and then additional charges being made as the hands increase, thus as five additional, ten, twenty, thirty, forty. The labor table makes a higher charge according to the classification for occupancy of the business. Thus, forty additional hands in the low grade adds 20%, but in the fifth grade it adds 65%. All devices which call for the use of heat are closely analyzed, and very intelligent work has been done with these factors. There is treated in turn the electric power, gas, hot air, kerosene or natural gas engine, and steam power as well as the standard gasolene engine. Apparently the electric power encased ranks the highest as it makes no addition, but if not encased there is no charge in the low occupancy grade but the charge becomes 20% when it reaches the 3½ grade.

Furnaces are divided into Hand Furnaces, Fixed Furnaces or Movable Furnaces. These are treated very consistently according to the hazard, the same as the power devices are.

There is also special recognition of the dry room hazard in all forms.

The third thing that affects the rate on occupancy is the question of damageability. Fire and heat are defined as direct effects and the others are resulting effects. This damageability is divided into four grades, as D-1, D-2, etc. D-1 is low as hardware, leather, or rubber stocks, etc. D-2 is middling, as retail dry goods, etc. D-3 is high, musical instruments, books, stationery, produce, etc. D-4 is extra as millinery, artificial flowers, florists' stock, etc. Three intermediate grades have been established, D-1½, D-2½ and D-3½. These are midway between their respective grades. Mr. Dean considers that so far as damageability is concerned it bears no fixed relation to the other factors in a risk, whether the construction of the building, the question of causation or combustibility. It is distinct in itself, and therefore a specific charge is made for damageability. The charge naturally varies according as the goods are located in the basement, ground floor, or some floor above. These occupancy lists are arranged in alphabetical order, and show three things; thus, to illustrate: Carpet cleaning establishments, one gallon of gasolene in a safety can allowed

1	2 &	3
25%	40%	D2

In number 1 the causation is estimated at 25 %, under number 2 the combustibility at 40%, while under number 3 in Damageability Table No. 2 will be found the proper charge to be added. This charge, of course, would be the one for the floor on which the tenant is situated.

Fire Protection and Exposure Charges: Public protection is divided into six classes, the first class being as follows: The water works to be of gravity, combined or a direct pressure system, with reserve or standpipe, pumps and boilers of required capacity. All specified standards to be fulfilled for the pumping station, the pressure, the mains, gate valves and hydrants. Finally, where necessary, an approved high pressure system. The fire department call for the full equipment of apparatus, full-paid men, hose and fire alarm system, while the ordinance should make provision for building, electrical and general inspection. The streets of the city or town should be of the standard width, well paved and lighted. This is the highest class, and from that to the sixth class there are gradual reductions in the requirements. Thus, the second class, the pumping station may be in a brick building instead of a fire resistive, there need be no high pressure system, and there may be a slight deficiency in gate valves. The fire department need not have quite as many men, the ordinances must be the same, but the wires need not be underground. The third class averages about three-fourths of the standard for the first class. The fourth class runs about 50 per cent. There is a four-and-a-half

class where the water works are not quite to the standard of the fourth class, the fire department is slightly deficient, and there are no ordinances. In the fifth class there are no water works, and the fire department is volunteer; there are no ordinances. Finally, the sixth class, there is no fire protection at all.

The analytic system works out a method of base rates in connection with these various classes on a plane running something as follows:

Class	1	2	3	4	4½	5	6
1 story,	$0.54	$0.61	$0.69	$0.78	$0.86	$0.94	$1.00

These base rates are increased for each story over one as illustrated by this table:

Class	1	2	3	4	4½	5	6
1 story,	$0.54	$0.61	$0.69	$0.78	$0.86	$0.94	$1.00
2 stories,	.57	.64	.73	.82	.91	.99	1.05
3 stories,	.60	.67	.76	.86	.95	1.04	1.10

The frame basis table makes the reductions less, thus: assuming a $1.00 rate in class 6 for a one-story building, in class 1 it would be $0.68. In other words, less credit is given a frame building for public protection than is given a brick building.

In regard to public protection consideration is given to the fact that there is a difference in its value to building and contents. There will be under high grade protection a greater relative loss so far as the contents are concerned than the building, the water damage making up, if not more than making up for the increased fire loss on contents as compared with the building in the unprotected territories. The treatment of the contents is based on the consideration of their damageability once a fire has started in the risk. Thus, in the basement of a risk a stock which would be classified under Damageability No. 1 at .30 would run up to .86 under Damageability No. 4. On the first floor it would be less and run from .22 to .74, but on the eighth floor and over it would run from .61 to 1.31.

Private Protection: Public protection deals with those factors which are controlled by the community as a civic problem. When we come to private protection credit naturally is only given to those buildings which are protected. The credit is a percentage of the final rate of the building, but does not include the exposures. This application of the credit to the final rate is largely for convenience and not for any other reason. The credits are as follows:

1. Inside standpipe and hose, 5%
2. Outside fire escape and standpipes on buildings three stories and over, 4%
3. Automatic fire alarm system, 10%
4. Chemical extinguishers or casks and pails, 5%
5. Watchman with approved clock, 5%
6. Watchman reporting to central station, 10%
7. Heat from outside source or no heat, 5%
8. Approved whitewash or fireproof paint on all exposed interior woodwork, 2%

Exposures: The work of the Dean Schedule in regard to Exposures is one of the best things in connection with the schedule. In fact it is a superb piece of work. It will be recalled that the schedule originated in an effort to work out the problem of rating frame rows or "ranges," as they are called in the middle western towns. The exposure is considered from three angles. First, all buildings radiate or give out a part of their own hazard to other buildings. Second, they absorb a part of the hazard of other buildings, and third, transmit or pass along part of this absorbed hazard from other buildings. Mr. Dean says that the extent to which buildings radiate, absorb and transmit hazard depends upon the fire protection of the city or town, upon the construction of exposing and exposed walls, and upon the distance between the exposing and exposed walls.

The consideration of the exposure starts with the rate on the exposing building, since presumably that measures the hazard of that risk. A standard is established by developing an average based on certain factors in the town; for instance, in a certain town experience might show that 40% of the rates as computed by the schedule furnish an adequate basis for exposure standards. Having established the standard, then at this point the construction of the walls of the two properties, risk and exposure, play a part. A very extensive table has been prepared which works like a formula and shows the percentage of exposure to be taken according to the distance, the construction of the properties, the walls, etc. This table naturally greatly facilitates the operation of the exposure table. The table will apply to at least eighty-eight (88) combinations of construction in exposing and exposed buildings. This furnishes the student with some idea of its value.

Some factors of the exposure are considered as abnormal, as where the area or height exceeds the average, special treatment is provided for such cases. Also when the area of a low building becomes less than the average, special treatment is provided for such cases. Abnormal exposures are graded as, Nil, Negligible, Small and Large. The first indicates structures so small that they may be left out of consideration. The second indicates risks so small or of such a low hazard that they may be ignored for all practical purposes, while Small and Large indicate properties which according to their size radiate more or less exposure than ordinary mercantile or light industrial buildings. The falling wall hazard is considered as well as the wall damage exposure. There is a small charge called a "starred risk exposure." This is based on a risk, which has a star in the occupancy, through a party or division wall without openings.

These notes will be sufficient, I believe, to put the student so far as is necessary for the examination, in touch with the "Analytical System. To become a master of it would require weeks of study, and such of course was not the purpose, nor could it be done in the time which we were able to devote to the subject. The high spots alone could be touched."

Agency Organization and Managemen

BY

WALTER L. WAKEFIELD

My talk to you this evening may impress you more by wha I do not say than by what I shall say. The time at my dispos is too short to allow me to go into the numerous minor detail incidental to an agency organization. I know that the me before me this evening have had more or less experience in th business and I believe my time can be spent better than b reading a technical paper, involving office system, powe and limitations of agents according to commissions which the may hold from their companies; correspondence work an detailed explanations of companies' rules and requirement the rules and requirements of local boards and similar orga izations, the different systems of rate-making, constructio work, installation of fire prevention facilities, etc., it is mor my intention in the short time which I have at my dispos to handle the topic more in a general way as I view it and a I have experienced it from a service of 35 years in the busines

The business of insurance, in all its branches, extendin as it does over the entire continent, necessitates the repre sentation of the companies by agencies. The developmen of the business in the field is through agencies of various charac ters, such as general agencies with wide authority operatin under salary or commission and contingent contracts, loca agencies with limited authority operating upon commissio agreement only, local agencies with more or less authorit operating under special contract, and special agents, who ar practically salaried employees of the home office travelling i the field, looking after over-due balances, inspecting risks adjusting losses, establishing agencies, etc. It is not necessar to go away from Hartford to witness illustration of the fac that there are as many different methods of agency manage ment, and consequent success, as there are different agencies What I have in mind and what I believe to be the purpos of this lecture is to discuss the ideal agency organization, i its scope and methods.

It must have been the desire of your committee who aske me to address you on this topic, that it be handled from th point of view of the proprietor or manager of an agency, there fore it is my intention to disregard agency organization an management from the Home Office point of view.

The ideal agency organization should have the necessary equipment peculiar to its particular environment to transact the entire field work in all branches, and be managed with ability equal to or exceeding home office standards. It assumes tremendous responsibilities and must be true to them. It is the companies it represents on the firing line, and to be successful, the service it performs for its clients and principals must be complete and of high order.

The agency organization of the present day is a much different proposition than it was 25 or 30 years ago when I started in business. In the old days, a fire insurance agent felt that his dignity was somewhat at stake if he transacted what was termed side lines of insurance, and the same was true of the life insurance agent, but today, in my opinion, the successful agency should write insurance in all its branches, including fire, life, accident, disability, compensation, liability, surety and contract bonds, for it would be surprising to those who do not know it, how closely related all forms of insurance are to each other. Obviously it is much more convenient and satisfactory for the assured to transact insurance business in all lines with one agency, with whom he has confidence. Moreover, this plan produces for the agency, extra profits, advantages and strength.

Familiarity with all forms of insurance and the desire and benefit of writing all forms of insurance aids the agency in the development of the business generally in new channels, and is largely responsible for many of the new forms of insurance that are constantly appearing, for instance, *hail* insurance on growing crops of tobacco, *fire* insurance on tobacco tents and growing plants, *life* insurance protecting partnerships, and business contract and group insurance, *disability* insurance covering assured against loss of time, corporation surety and contract bonds that have completely replaced personal bonds, et cetera. You may depend upon the man who derives profit and satisfaction in the growth of his business; for new ideas.

So I believe that a well equipped and developed agency organization should represent and understand every line of insurance.

There are no uniform hard and fast rules, or even well developed uniform methods governing the operations of the management of an agency organization. It is a matter that each has to follow and develop according to his own abilities and his individual advantages or disadvantages, inasmuch as while there may be several agency organizations in the same city transacting all kinds of business, the size, resources, and underwriting ideas, etc., of each may differ as they do among companies themselves. In general, however, naturally the usual

fundamental principles necessary for the proper conduct of all business underlies that of proper agency organization and management.

The aim and ambition of the agency must be to serve with fidelity and ability both the interests of its companies and its clients. The management, however, cannot be successfully conducted unless it is entirely familiar with the rules and regulations of the various underwriters boards and associations, which govern not only the practical but also the ethical side of the business, and also be familiar with state laws referring to insurance, and the underwriting ideas and policies of the companies represented; it must also have tact and character to win the confidence of the insuring public.

I have heard it stated that theoretically all that is required by the companies, of an agency organization, is that it should write its policy contracts correctly, report promptly to the companies, produce sufficient business and pay its accounts when due. As a matter of fact, I must admit that an agency that does all this, though it may do nothing more, is valuable, but it is also held that the acceptance and rejection of risks, inspections, adjustment of losses, etc., should be left to the executive management of the companies. This theory, I think, is exploded, at least as far as real agencies are concerned, although it may apply to the very small or undeveloped agencies. The insuring public is becoming more inclined to place confidence in and patronize an agency that is equipped not only to write insurance of all kinds, but to handle all details incidental to the business as far as the patrons of the agency are concerned, such as selection of companies and settlement of losses. The duty of the agency towards its clients and companies in the matter of losses and adjustment of same, in particular, is of supreme importance: it is necessary to serve the best interests of the clients as well as the best interests of the company, and this *can* be accomplished by serving with fidelity, honesty and ability, the aim, ambition and ideal of the agency organization.

It has been my experience that the average assured looks upon the average special agent or adjuster of the company as a natural enemy, feeling that the expert is called in to make as good an adjustment as is possible, that is — settle for the least amount, and he frequently makes exorbitant claims, with the expectancy that they will be cut down and that he will approximate an adequate amount at least. On the contrary he will have confidence in the agency to whom he has entrusted his business. Consequently the agency is usually able to make equitable and satisfactory settlement of losses, both as far as the assured and the company is concerned, thereby leaving a better feeling all around, all of which contributes to the good of the business, and success and profit to the agency.

Moreover, all this aids in the development of better local conditions, such as reduction of physical hazards, and, consequent reduction of loss ratio, followed by reduction of rates, a matter always appreciated by policyholders. Also an agency organization of this ideal type creates such a community of interest between the agency and the companies that they become almost inseparably connected as integral parts of a complete organization, in which both are necessary for the greatest success. In this way the agency and the companies represented gain strength, popularity and dignity, rising above that false position that is very frequently attributed to agencies, as being "premium grabbers" only, with no responsibility or regard for results.

It seems logical that the most satisfactory agency organization, as far as the companies are concerned, is the agency that has earned by its fidelity and ability the complete confidence and respect of the companies. It then follows that the acceptance and rejection of risks may be safely left to judgment of the agency. This places very important responsibilities on the agency which are invariably appreciated with profitable results because the agency is so familiar with local conditions it is more competent to judge of the physical and moral hazards.

In consideration of these points, it seems that the proper and most successful management of insurance agency matters contemplates transaction of the entire business directly connected with the agency, from soliciting risks to adjusting losses, and even underwriting risks.

It may seem that this leaves few responsibilities for the insurance company in the conduct of the agency, but I am certain that the company official could follow with a lecture on "Home Office Management," and amaze you with the multitudinous affairs necessary for the proper management of the Home Office, and yet leave all the matters to which I have here referred in the hands of the agency.

You may doubt as to whether there are many insurance agencies that perform all the functions that this ideal organization would, but I can assure you that there are many such agencies in successful operation, and the successful agency of tomorrow will be the agency that is conducted along those lines.

To perform all these duties, however, it necessarily follows that there must be competent and methodical management.

In the first place, the manager or management must be familiar with all details of agency work, so that he may be able to delegate the work, and be sure that it is being correctly handled. It is said that the General who has forgotten how to mount guard is no longer a capable general. So the head of an agency organization must thoroughly understand the work he is delegating to subordinates. If there is any position in the office he is incapable of filling, he should immediately "go

to it" and learn it. He must have such a complete grasp of details that if there were a strike on his hands, he could personally instruct others to replace the strikers. Not only must he understand all details, but he must also be sure that they are being efficiently administered. He should know about purchasing supplies, and be familiar with his finances and accounts. He should be as careful in executing a $500 household furniture policy as he would of a $50,000 fidelity bond. He should know whether the policy clerk is filling that position all right, or not, and be able to sit at the desk himself and correctly write policies, forms and endorsements. He should know as much, yes even more, regarding the financial affairs of his agency, than his cashier; if he does not, he should swap jobs with the cashier until he does. In short, he should keep familiar with all details of his business, even though he may have to sacrifice time that he would like to spend on the golf course. If not he becomes a "has been" before he knows it. It is all well enough to employ others to do your work, in fact, of course, this has to be done, but what I am trying to show is that the executives of the agency cannot afford to be neglectful but must be eternally vigilant, and should know from personal knowledge whether the affairs of the agency are going right or not. It is the ambitious and capable man who keeps cognizant of all details of his business and only through such interest can thorough precision and effectiveness be adequately maintained.

Now that we have considered somewhat the agency management, let us turn our attention to general operations.

The business of insurance, as I have previously stated, is essentially an agency business: its business must be produced and its field work conducted by agency organization. It behooves the companies therefore to encourage the agency in developing itself into an ideal agency. So agency organizations have every reason to expect, and if not received in full measure, have the right to ask for the fullest support and coöperation of its principals. On the other hand, the companies have every reason to expect and, indeed, have the right to demand active service in the agency from the ground up.

An agency, from the very nature of its organization, cannot survive unless it solicits business, and this is of paramount importance. The agent, who hesitates, and does not solicit a possible prospect, or who is afraid of his dignity (false pride is perhaps a better term) to measure up a plate glass risk on Main street, or to solicit his neighbor or friend or stranger for insurance, or has no systematic plan of soliciting new business continuously, is the agent or agency that has deteriorated and lost its grip. Dignify your business by maintaining activity in all lines, soliciting in particular, since by doing this earnestly and comprehensively success is certain, and you dignify yourself and your business.

Soliciting business may be conducted in many ways, too numerous to mention, but it is *the* source of prosperity of the agency and is responsible for all the activities of the office which follow. Its first effects are seen in the policy writing department, which must be equipped with all the necessary and latest policy forms, then as the policies are written the daily reports go to the mapping department and the office record goes to the accounting department, then the bookkeeper must get busy with the collection of premiums, a matter that in an agency office is second in importance only to the securing of business.

I remember, it seems years and years ago, attending a play in which that famous actor, the late Sol Smith Russell took the leading rôle. He said in part: "Once I had a friend, and I had some money. I loaned my money to my friend and now I have no money and I have no friend." An established maxim is: "Short credits make long friendships." This ought to be all that is necessary to say on the subject of collections. An agency does not need much experience in the business before it discovers that it is absolutely necessary to conduct the business along the lines of limited credit and close collections, and unless the business is so conducted you are liable to find yourself out of business before you have had an opportunity to test all the rules and theories of the insurance business that you have gathered together and absorbed from your Insurance Institute courses. If you are going to continue in the business and make a success of it, it is imperative that you collect your bills promptly and pay your companies without fail when your accounts are due. The first experience in outside work, of the rising young man, the future underwriter of the business, is very often confined to delivering policies and collecting bills, important work which cannot be handled by an office boy since it brings together in direct personal contact your representative and your client. I have no fear for the future success of the young man who can handle these two matters successfully and tactfully. Work along these lines developes the young man and leads to promotion. He has opportunities to solicit business, make friends, and gain more knowledge of the business; he advises with prospective clients; he observes conditions and reports on same, and before he knows it he is inspecting business, and as he is an ambitious and inquisitive and withal energetic young man, he soon discovers that the greatest rewards are won by the business getters. He studies the agents' manual of rates and forms; he gets interested in the work of Underwriters' Associations, becomes familiar with inspection bureaus and the functions of local boards. Later he finds himself capable of advising clients or prospective clients as to the value of the installation of fire prevention facilities and of proper construction.

Later, as he is a young man intent on knowing the business in all its details as regards agency work, you will find him adjusting losses and doing the work so well that he makes the "man higher up" feel like an old timer. In this way, his logical landing place is close to the head and he becomes the right hand man of the executive. That is a fine and enthusiastic picture I have drawn of the young man, and, moreover, one true to life, for I have witnessed such results many times.

I must hurry along. I am afraid that I have almost exhausted my time allowance, but there are only one or two more matters that I want to mention. I cannot neglect this opportunity of bearing witness and acknowledging before this gathering composed mostly of young men who are intent on perfecting themselves in their chosen profession or business, that the business of insurance is a dignified business, so dignified, in fact, that it has been termed by some a profession, although this does not in my opinion dignify it any more than classified in its right place as a business, which attracts to it the dignified and capable man. It is a business of larger affairs and carried and developed along proper lines is remunerative. As the progress and development of this great business of insurance, so vitally necessary to the prosperity of our national business life, is affected to the very highest degree by the army of agents and agency organizations, covering, as they do, the entire country and grouped in various boards and associations, the maximum of effort should be exerted at all times by all engaged in the business, either individually or collectively, through their trade organizations, or through whatever legitimate means there may be in their power to direct, to encourage, to build up and increase the high moral and business calibre, the fraternity so well enjoys today. This should be one of the unqualified obligations of each and every agent and agency organization in the business.

The insurance press is one of the most important factors that well support the highest ideals of the business, reflecting as it does the thought, practice and progress of the companies and agencies, and I believe it is impossible for an agent or agency organization to make a better investment than, either by subsubscribing to or advertising in or both, to help support our more representative publications. Indeed, it is almost a duty to do so, and no agent or agency organization can keep abreast of the times unless their trade papers are regularly received and read.

In conclusion, I wish especially to emphasize the truth that no more honorable, active field of endeavor in the business world exists than that of insurance in all its branches, and no field with such unbounded opportunities or greater reward, if you distinguish yourself by ability and fidelity.

The business combines continuous study with most active practice. It keeps men young, inasmuch as it keeps them active in the heat of the fray of business life. Opportunities fairly beckon for the expansion of your business life and boradening of your attitude toward your fellow man, which all results in the development of your own character, and incidentally the reward for the fulfillment thereof, which brings you to the goal of ambition. I would also leave with you a thought that whether you will be interested or are now interested in the agency organization from my point of view, or the company's point of view, that you will add your assistance to influence officials of the companies to recognize more the value of well organized agencies and use every effort to develop them to a state of efficiency fully equal to home office management, for by so doing they are performing as valuable a service to their companies as it is possible to render.

I cannot bring my remarks to a close without expressing appreciation of the honor you have conferred upon me in so cordially inviting me to address you, and to wish continued strength to the good work to which your Institute is committed, with the hope that many of you in due time, if you are so inclined, may personally witness successful and practical demonstration of the schooling received through the medium of the Institute.

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